Devoted to
TEXTILE
CHEMISTRY
BLEACHING
DYEING
PRINTING
FINISHING

RCH 27, 1944
LUME 33, No. 7

AMERICAN DYESTUFF REPORTER

TELESCOPING TIME

War has hastened the development of new methods of coloring certain fabrics. For example, the newly developed methods of dyeing wool with Indigo will no doubt greatly extend the use of vat colors on this fiber. Military demands have also resulted in greatly increased production of Ponsol* dyes.

During this period, it should be mutually helpful for us to work together. Our laboratories can help you solve your war-time technical problems. We may, in addition, telescope time by accumulating vital experience and knowledge that will bring profitable solutions to *post-war* problems. E. I. du Pont de Nemours & Co. (Inc.), Organic Chemicals Department, Dyestuffs Division, Wilmington, Delaware.

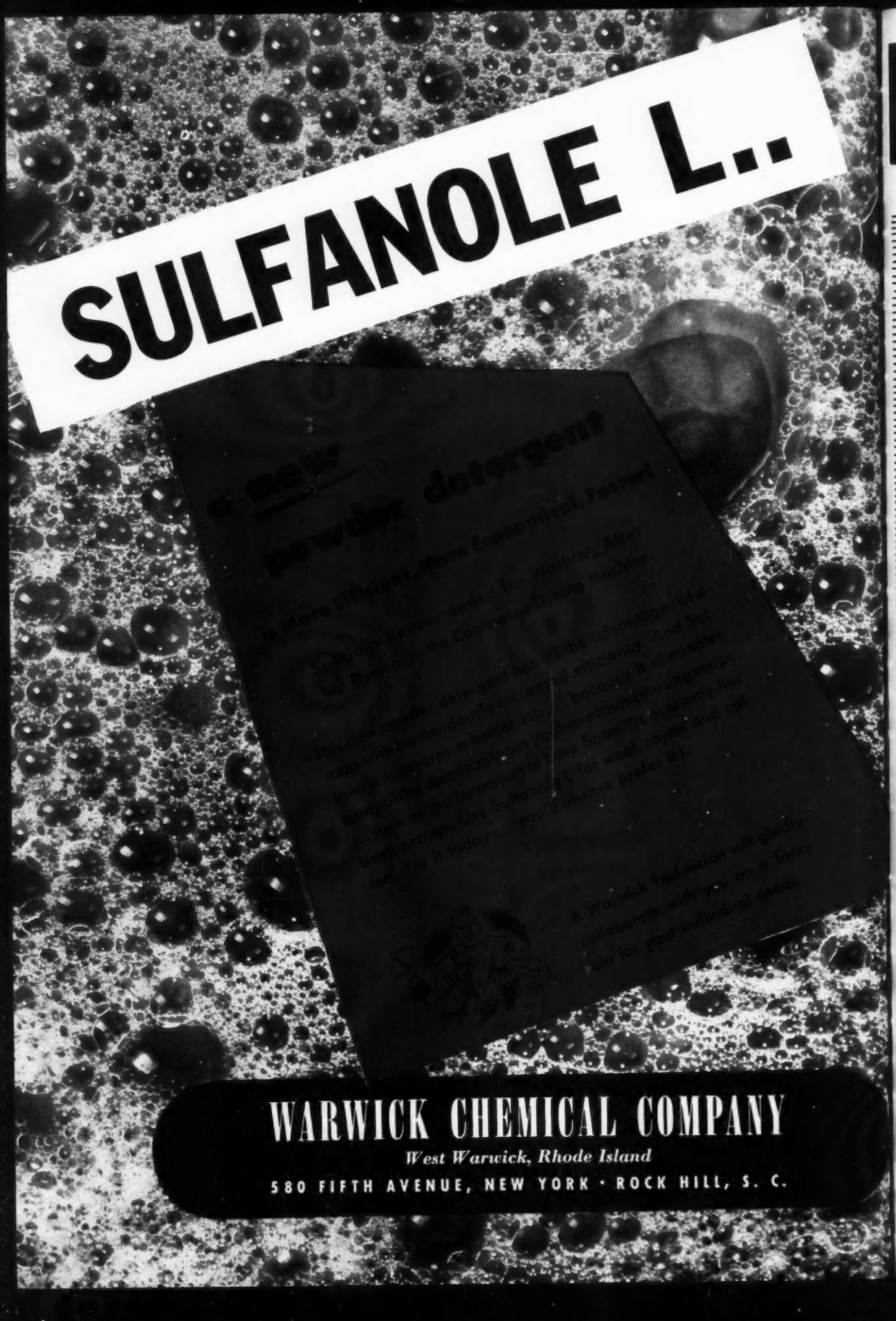
*Reg. U. S. Pat. Off.

Du Pont Dyestuffs

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

AATCC

IAL PUBLICATION
of the
ROCEEDINGS
CAN ASSOCIATION
XTILE CHEMISTS
D COLORISTS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WARWICK CHEMICAL COMPANY
West Warwick, Rhode Island
580 FIFTH AVENUE, NEW YORK · ROCK HILL, S. C.

LEVELENE*

FREE FLOWING, NON-JELLING

More than a trade name.

A penetrant and levelling medium for direct, union, and CELANESE* dyes.

Effective either for stripping or for level dyeing when working with many of the vat type dyes.

A stable, dispersing penetrant for rotproof and mildewproof processing.

Economical and labor saving.

RATHER than ask for a laboratory sample—HAVE one of our technical men bring with him a sufficient quantity for a practical mill run. THEN judge for yourself as many mills have done and profited thereby.

*Reg. U.S. Pat. Off.

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50 UNION SQUARE
NEW YORK, N. Y.

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Plant: Lock Haven, Pa.

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190 High Street

Chicago, Ill.
820 South Clinton Street

Charlotte, N. C.
301 East Seventh Street

Los Angeles, Cal. — 1019 South Grand Avenue

*Reg. U. S. Pat. Off.

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We certainly are getting faster results with this new ALKAMINE K50

Yes, and have you noticed how much cleaner and clearer the colors are?

Alkamine K50 is a powerful new detergent for scouring and dyeing of cotton yarns and piece goods. Its high detergent properties will readily replace soap in the soaping-off bath for vat dyes.

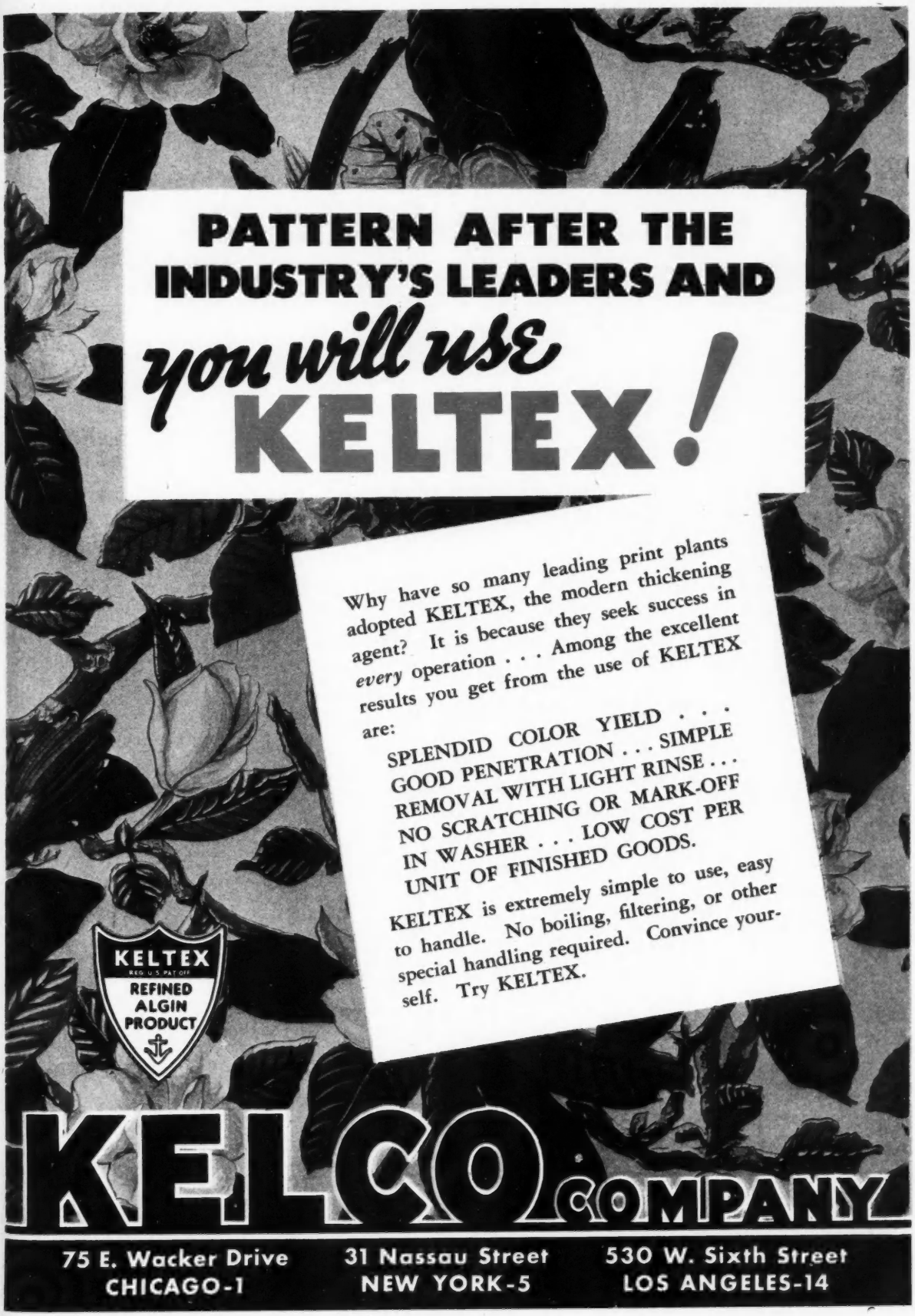
With Alkamine K50 in the scouring bath, goods are clearer and cleaner—in half the time ordinarily required. There are no lime soap deposits to cause streakiness in the dyeing . . . You get consistent and uniform dyeing results.

For complete satisfaction, try Alkamine K50. You'll discover (1) increased wetting ability, (2) stability to hard water and (3) stability to lime salts, magnesium salts, iron, organic or mineral acids.

If you have a problem in textile processing, or hosiery finishing, write us. We offer you a complete line of textile finishes, dyeing agents, penetrants and softeners *plus* the services of Representatives who are trained technical men.

ALKAMINE *K-50*

Amalgamated Chemical Corp., Philadelphia 34, Pa. Southern Representative: Robt. A. Bruce, P. O. Box 35, Greensboro, N. C. : : Makers of a complete line of Textile Finishes, Dyeing Agents, Penetrants and Softeners.


PATTERN AFTER THE INDUSTRY'S LEADERS AND
you will use KELTEX!
Why have so many leading print plants adopted KELTEX, the modern thickening agent? It is because they seek success in *every* operation . . . Among the excellent results you get from the use of KELTEX are:
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KELTEX is extremely simple to use, easy to handle. No boiling, filtering, or other special handling required. Convince yourself. Try KELTEX.
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For that soft, luxurious, downy handle and other various special effects, Onyxsan enables dyers and finishers to obtain remarkable results. The Onyxsan group of finishing agents are substantive to cellulosic fibers and produce a pleasing, wash resistant finish.

Your inquiries are solicited.

*For downy softness on all types of fabric, even the most delicate shades —use Onyxsan.

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PROVIDENCE • CHARLOTTE • CHICAGO • LOS ANGELES • TORONTO • MONTREAL

AFTER THE WAR

After the storm of war is over...there will be a rainbow of more cheerful colors breaking over the world which will echo new notes of courage and optimism. When we have won this conflict, the sombre hues and drab garbs of these dimout days will be supplanted by an inevitable reversion to brighter colors.

When peace comes, General's phenomenal war production will be converted to peacetime requirements, releasing unlimited quantities of the finest and most durable dyestuffs known.

GENERAL DYESTUFF CORPORATION

QUALITY DYESTUFFS

STEIN-HALL OFFERS MILDEWPROOFING COMPOUNDS

Our Technical Staff is ready to cooperate with textile finishers working on Government contracts requiring mildewproofing, or on mildewproofing of fabrics for civilian and post-war use.

*CUPRINOL COPPER NAPHTHENATE meets the Type I chemical requirements of the Corps of Engineers, U. S. Army, Tentative Specification T-1452A, January 15, 1943.

CUPRINOL ZINC NAPHTHENATE, colorless, is available for mildewproofing with dyes to meet color specifications.

CUPRINOL COPPER AND ZINC NAPHTHENATES are supplied in various concentrations and flash-points to blend more readily with the solvents which are most effective in producing waterproof, flame-proof and dyeing compounds for treating fabrics.

CUPRINOL has minimum odor and is economical . . . non-irritating to the skin . . . may be applied at high speed and dried at temperatures up to 250° F . . . does not stiffen fabrics nor affect their inflammability.

RESOMIL, an aqueous solution of copper ammonium fluoride containing 10% copper, meets the Type III chemical requirements of the Corps of Engineers Specification T-1452A. Non-inflammable . . . diluted with water . . . practically no leeching . . . no sludge left in the container.

ASK FOR SAMPLES OR CONSULT US ABOUT YOUR MILDEWPROOFING PROBLEMS.

*CUPRINOL PRODUCTS ARE MANUFACTURED BY CUPRINOL, INC., BOSTON, MASS.

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ULTRAMIN*

THE SUPERIOR FINISHING MEDIUM

Relegate yesterday's finishing mediums to the scrap heap. Get to know the most modern development in the textile industry - ULTRAMIN.

Chemically, ULTRAMIN can be identified as an aliphatic alkypolyamine. The formula for this superior textile finish is the result of many years of intensive research . . . and its economic advantages have been proved in leading textile mills.

Fabrics and fibres finished with ULTRAMIN acquire a permanent, soft finish . . . which even consecutive launderings will not impair. In addition, ULTRAMINIZED fabrics will withstand consecutive dry cleaning operations without losing the original finish or drapy hand.

ULTRAMIN is a preparation which is adaptable to every phase of textile finishing. It is particularly ideal for the processing of all rayon fabrics, rayon and acetate fabrics, acetate fabrics, rayon yarns, acetate yarns, spun rayons, and hosiery.

ULTRAMIN is more economical, and because in most cases it can be applied in the last wash, substantially cuts processing costs. We shall be glad to send you a laboratory sample. Better yet, you can have one of our technical men bring a sufficient quantity for a practical mill run.

SIMPLIFIES PROCESSING LOWERS COSTS

- Ultramin eliminates application of softening agent in the mangle.
- In most cases Ultramin is used in the last wash, after dyeing.
- Reduce finishing operation to framing only in most cases.
- Leading textile mills have Ultraminized millions of yards with gratifying results.

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INCORPORATED

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OTHER ULTRA CHEMICAL PRODUCT DEVELOPMENTS . . . . DETERGOL • SULFRAMINE DT PASTE
SULFRAMINE DR PASTE • SULFRAMINE POWDER • ALBUTEX • ALBUTINE • DERMASOL • ULTRA GLOSS B • DULLITE T

* Ultramin is made from an exclusive formula — U. S. Pat. Pending

ULTRAMIN—REG. U. S. PAT. OFF.

Congratulations

ON A FINE JOB, WELL DONE!

THE Treasury "Star" Flag—the bond-buying counterpart of the Army-Navy "E"—marks plants with at least 90% of personnel participating in the Payroll Savings Plan to at least 10% of gross payroll, *and also having recched, or topped, a War Loan Drive quota!*

The successful close of the 4th War Loan Drive finds many more "Star" Flags than ever before flying over the industrial plants of America. To all these, go the heartiest thanks of the nation, and the deep appreciation of the Treasury Department for a great job! And to those who may not quite have qualified for the "Star," go equally sincere thanks—and the confidence that soon they, too, will join the ranks of the "Star" fliers.

One thought that many concerns have found helpful in stepping up the intake from their Payroll Savings Plans is this. In many cases the Treasury Representative in a plant has been able to point out the fact that during *Loan Drive periods* the employees have found it possible to spare much more than they had counted on when setting up their original subscription, and that—*when properly approached*—a very substantial fraction of such employees will decide they can well afford a distinct increase in their current Payroll Savings Plan.

Talk this over with your Treasury Representative—it offers important possibilities when correctly handled. And again accept the Treasury Department's congratulations for your fine work in helping to put over the 4th War Loan.

The Treasury Department acknowledges with appreciation the publication of this message t

LET'S **ALL** KEEP
BACKING THE ATTACK
WITH **WAR BONDS**

AMERICAN DYESTUFF REPORTER

This is an official U. S. Treasury advertisement — prepared under auspices of Treasury Department and War Advertising Council.

Some girls use them for marching . . .

OFFICIAL U. S. NAVY PHOTO

Today, even the top sergeant counts on her legs for more than marching. Because she knows the potency of properly sheathed underpinnings, she's extremely critical of today's hosiery. To her, "service hose" is more than a buyer's term . . . it represents the type of smooth-fitting, properly finished hose that she and her sisters-in-uniform demand and get. Yes, with women in service, just as with women at home, hose must have that soft, sheer, lasting smoky-dullness or they're out. ● For years Fancourt chemists have helped hosiery makers and dyers to satisfy the most beautiful legs in the world . . . the American girl's. Now, with the job harder than ever before, our staff is working night and day to develop formulae for handling all types of new problem-materials. A talk with one of our field men will convince you that we have not worked in vain.

W. F. FANCOURT & CO.

PHILADELPHIA, PA.

Solving Finishing Problems Since 1904

In the South: Howard A. Virkler, Greensboro, N. C.

Lessons WE learne
will help solv

KOPAN ★

PATENTS PENDING

THE PERMANENT CELLULOSE FINISH

Plants turning out millions of yards of military fabrics — head nets, mosquito bars, "shrimp" nets, collar-linings and other items — use KOPAN to help them meet the exacting standards set by the government.

★ REG. U.S. PAT. OF

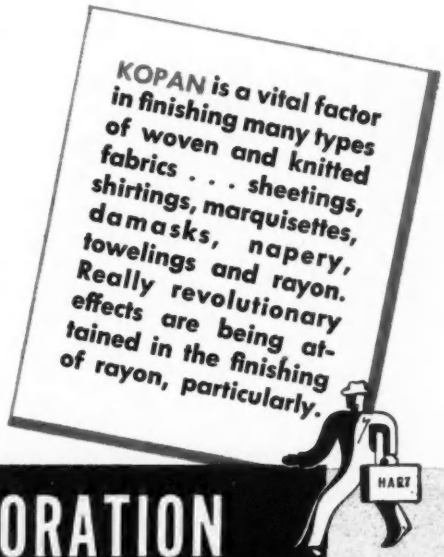
KOPAN — imparts permanent finish . . . increases tensile strength and abrasion resistance . . . controls shrinking and stretching . . . eliminates slippage . . . improves hand and appearance . . . produces lint-free fabrics.

n this war
OUR peacetime sales problems

• KOPAN opens the way to new sales outlets and greater profits in the merchandising of fabrics for civilian use.

And Now . . . A Permanent Antiseptic Finish

KOPAN, the permanent cellulose finish, when combined with an approved mildew-and-bacteria resistant formula, produces a *permanent* antiseptic finish. Not only this combination but the addition of Celludye pigment colors . . . are all applied in a single bath operation! No better time than *now* to prepare for after-war merchandising by consulting our technical department as to what KOPAN can do for *your* product.


KOPAN is a vital factor in finishing many types of woven and knitted fabrics . . . sheetings, shirtings, marquisettes, damasks, napery, towelings and rayon. Really revolutionary effects are being attained in the finishing of rayon, particularly.
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A Few Products of QUAKER CHEMICAL RESEARCH:

Modern synthetic resin and ester products for distinctive fabric finishes.

New type stock lubricants for wool, rayon and cotton fibres.

Special synthetic plasticizers and binders for cotton and rayon warp sizing.

Improved type water repellents.

Synthetic detergents and penetrants.

Scrooping compounds.

Fulling and scouring compounds.

Quaker Chemical puts the EMPHASIS ON RESEARCH

Develops products and processes to overcome problems heretofore inadequately handled

MORE THAN a decade ago, we at Quaker Chemical dedicated our organization to the task of locating processing problems in industry which we felt have never been handled quite satisfactorily . . . and to developing chemical products and processes that would overcome past troubles.

So, today, the heart of the Quaker Chemical organization is its laboratory—or, rather, its laboratories—for there are *two* separate "labs" at our Conshohocken plant. One, the Control Laboratory, inspects all incoming raw materials as well as our own finished products. The other, a corner of which is shown above, is devoted entirely to research and development.

Heading these two "labs" is an eminent scientist who has studied at four leading universities, both here and abroad, and who has personally been granted more than 40 practical patents.

The Research group comprises more than 25 chemists and engineers . . . most of whom have accompanied Quaker Process Engineers on their field service calls and are, therefore, familiar with textile processing and are able to envisage the practical side of every mill problem.

These technicians work on special problems and permanent projects directed toward basic research on new synthetics for permanent water repellency, shrinkage control, crush resistance, and mildew prevention. Studies are also under way on the development of synthetics for warp sizing and stock lubrication. This work is carried on in a large, modern, open laboratory where every individual knows the work of the other.

In addition to the work of this group, Quaker Chemical also maintains fellowships and sponsors research projects in five leading universities.

Probably no other similar manufacturing organization devotes so large a proportion of its facilities and energies to research.

That this policy has borne fruit is evidenced by the many new type Quaker Chemical products that have already won wide acceptance throughout industry.

Just how far-reaching will be the effect of some of these developments on textile processing remains to be seen. In some cases their performance has been truly outstanding . . .

But rather than make extravagant claims for these products, we prefer to use this method of inviting you to establish contact with us . . . so that your mill may share immediately in whatever benefits emerge from Quaker's never-ending research.

A Quaker Process Engineer will gladly call and discuss with you just where our new developments may fit into your textile processing picture. Simply write or wire—

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CONSHOHOCKEN, PA.

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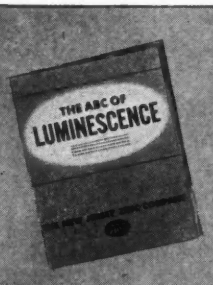
THE USE OF LUMINESCENT PIGMENTS —NOW AND TOMORROW

LUMINESCENT PIGMENTS—both the Fluorescent and Phosphorescent types—are manufactured and used on a tonnage scale in a number of essential war applications—luminescent dials, computers, charts, instrument identification plates on combat planes; and luminescent tape directional and identification markers on shipboard and in the field.

Because of these war demands, only limited quantities of Luminescent Pigments for civilian use are available right now. That condition, of course, will change as soon as wartime needs have been met fully.

In the meantime, our laboratories are working constantly on new applications for these pigments—in paints, paper, plastics, and inks. New markets are opening up. Why not put this knowledge to use today in developing your products of tomorrow?



"The ABC of LUMINESCENCE," a new booklet, is ready to go to press. It tells the story of Luminescent Pigments—Properties, Advantages, Applications—in simple, easy-to-understand language, and is profusely illustrated. It will be mailed upon request as soon as available.

SEND FOR YOUR COPY **of this new booklet.**
No obligation, of course!

FACTS ABOUT LUMINESCENT PIGMENTS

1. Sixteen grades and color types ranging from violet to red have been developed.

2. These pigments are activated by a near ultraviolet (*so-called "black"*) light, or a short wavelength visible light.

3. They contain no radium or radioactive salts.

4. They **no longer** cost $30.00, $10.00 or even $8.00 a pound, the pre-war price range.

5. These pigments are available in quantity at prices from 90¢ to $2.50 per pound.

6. They are stable enough to be used out-of-doors.

7. Luminescent Pigments are used in:

Paints & Lacquers	**Coated Textiles**
Plastics	**Printed Textiles**
Coated Paper	**Decalcomanias**
Filled Paper	**Printing Inks**

8. Fluorescent Pigments are fine in particle size, and may be ground exactly as conventional pigments. They are activated only by "black" light, which equipment has been developed in a wide range of styles and prices.

9. Phosphorescent Pigments may be activated by any light source when used only for their afterglow properties. While coarser than fluorescent pigments, they are fine enough to be incorporated into plastics and paint.

10. The afterglow of the Phosphorescent Pigments varies with each pigment, the intensity of the activating light, and the length of activation, ranging from a few minutes duration to ten or twelve hours, and longer.

New Jersey Zinc

Development Products Division

THE NEW JERSEY ZINC COMPANY

160 Front Street, New York 7, New York

Chicago — Boston — Cleveland — San Francisco

The requirements of our Armed Forces are taking a very large portion of the production of Sylvania cellophane. The balance is going into essential civilian uses.

When the war is won we promise that Sylvania cellophane, with its new improved qualities will again play its full part in civilian uses.

*Sylvania** *Cellophane*

*Trade Mark Reg. U.S. Pat. Office

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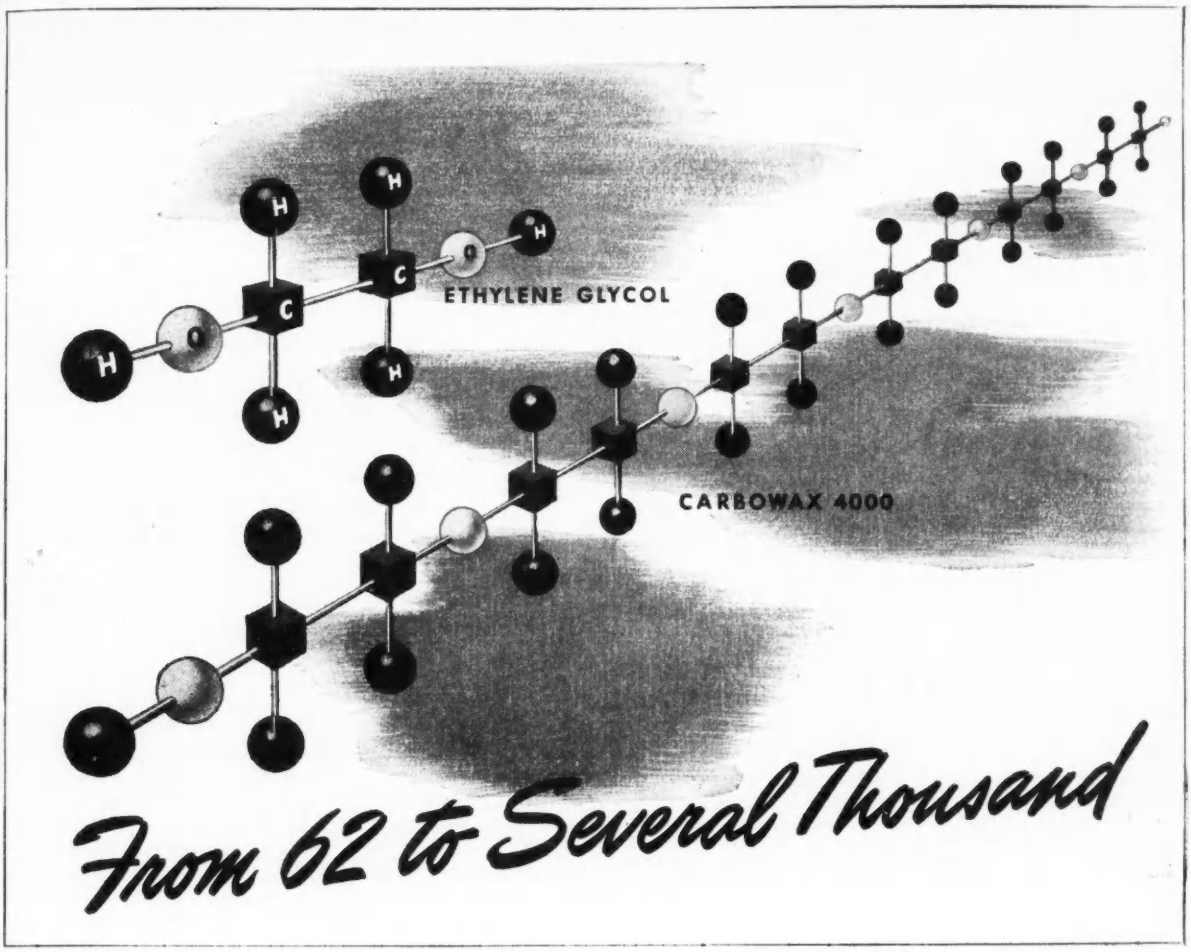

From 62 to Several Thousand

THE two molecules pictured here are smallest and largest in the family of glycols produced by Carbide and Carbon Chemicals Corporation. With molecular weights from 62 for liquid Ethylene Glycol to several thousand for wax-like Carbowax compound 4000, the family consists of 5 simple glycols and numerous polyglycol mixtures. These chemicals are so important that some of them are now restricted to essential war applications.

The glycols have distinctive family traits: water solubility, a wide range of hygroscopicities, low vapor pressures, high boiling points, and the ability to lower the freezing point of water.

In the textile industry glycols are especially important as humectants, as well as in softening and lubricating fibers. Glycols are good solvents for a variety of dyes and are used as well in the preparation of non-drying printing pastes.

Carbowax compounds are particularly useful in the dispersion of dyes and for the lubrication, softening, and sizing of textiles where their complete water-solubility facilitates their removal.

Carbide and Carbon Chemicals Corporation was the first chemical company to develop large-scale production of glycols. Our chemists and engineers have also pioneered the development and production of 12 other important chemical families . . . including alcohols, ethers, amines, and ketones . . . useful raw materials for many industries.

Today we are producing in commercial quantities more than 160 synthetic organic chemicals . . . and more than 40 of these in tank car quantities. After the war these versatile chemicals will be available in greater quantities than ever before, and many new compounds with them.

For further information about the use of these chemicals, write to us.

SOME OF THE GLYCOLS WE MAKE

- Ethylene Glycol
- Diethylene Glycol
- Triethylene Glycol
- Polyethylene Glycols
- Carbowax Compounds
- Propylene Glycol
- Dipropylene Glycol

BUY UNITED STATES WAR BONDS AND STAMPS

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

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30 East 42nd Street, New York 17, N. Y.

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

"Carbowax" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

12599
SUCCESSFULLY SERVING THE WAR EFFORT . . . —
ARKANSAS PRODUCTS
Designed to meet rigid government specifications are rendering a distinct service toward the ultimate victory . . . —

MILDEW INHIBITORS

for various types of cotton cloth and yarn
non-toxic—non-irritating

FUNGICIDE M: a single product combining a mildew inhibitor and water repellent for producing a mildewproof water repellent finish on insect netting, tapes, sheeting, webbing, thread, etc., in one operation.

FUNGICIDE PG: for mildewproofing duck, plied-yarns, etc., by the two bath method.

FUNGICIDE GM: used in conjunction with water repellents in a one bath treatment to mildewproof cottons and impart a water repellent finish.

FUNGICIDE A: a mildewproofer for cloth coating processes . . . — used directly in the vinyl resin solution.

AQUAROL*: produces a water repellent finish on uniform cloth, overcoatings and other military fabrics . . . — may be used in a single bath treatment with Fungicide GM to impart water repellency and mildew resistance to cottons . . . — also used in single bath with Arko Fire Retardant to produce water repellency and fire resistance.

ARKO FIRE RETARDANT: for flameproofing uniform cloth, tentage, felts, etc.

CULOFIX L*: used as an after treatment in last rinse to prevent color bleeding in water of direct dyed cotton or rayon.

* Reg. U.S. Pat. Off.

ARKANSAS CO. INC., NEWARK, N. J.

Established 40 years

HOW HOOKER *Serves* THE TEXTILE CHEMIST

HOOKER HE CO ELECTROCHEMICAL

The Hooker Chemicals listed below are products which serve in the making of dyes, in the making of intermediates, as dyestuff chemicals and auxiliaries, and for organic synthesis.

ALUMINUM CHLORIDE, ANHYDROUS
A grayish white solid used as a catalyst for Friedel-Crafts syntheses to produce dyes.

ANTIMONY TRICHLORIDE, ANHYDROUS
White crystalline solid used as a catalyst in organic syntheses to produce dyes.

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A clear, colorless liquid for the manufacture of dyestuff intermediates.

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BENZOYL CHLORIDE
A clear, colorless liquid for the manufacture of synthetic organic chemicals through Friedel-Crafts reactions to produce dyes.

BENZYL CHLORIDE
Clear, colorless to light yellow liquid for the manufacture of dyestuffs and intermediates.

CHLOR ANISIDINE
White crystalline solid for manufacture of dyes.

2:5 DICHLOR ANILINE
Light brown colored solid for dye intermediates.

META NITROBENZOYL CHLORIDE
Yellow crystalline solid for manufacture of dyes.

MONOCHLORBENZENE
Clear, colorless liquid for the manufacture of sulfur black and brown dyes and other dyes.

MONOCHLORTOLUENE
Clear, colorless liquid for the manufacture of dyes.

PARA NITROBENZOYL CHLORIDE
Yellow crystalline solid for manufacture of dyes.

PHOSGENE
Colorless gas or light yellow liquid for the manufacture of dye intermediates.

SULFURYL CHLORIDE
Clear, colorless liquid for the manufacture of chlor phenols.

THIONYL CHLORIDE
Clear, colorless liquid for the manufacture of organic acid chlorides and anhydrides, alkyl chlorides from corresponding alcohols.

OTHER HOOKER TEXTILE CHEMICALS

Caustic Soda • Chlorparaffin • Liquid Chlorine • Muriatic Acid • Sodium Sulfhydrate
Sodium Sulfide • Sodium Tetrasulfide

Write for detailed information about these products, or for the complete list of Hooker Chemicals.

HOOKER ELECTROCHEMICAL COMPANY

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ARMY E NAVY

HOOKER CHEMICALS

5077

Indigosol Grey IBL

for Bluish tone Greys

INDIGOSOL Grey IBL produces clear, bluish-tone Greys of very good fastness for printing, dyeing and padding. It can be shaded with any of the Indigosol Yellows, Orange or Browns to obtain any of the shades of Grey desired.

One of its most important characteristics, in addition to its excellent penetration of heavy goods, is that it produces very level shades which are well covered *even in the lightest tones.*

INDIGOSOL Grey IBL is readily soluble and belongs to the class of Indigosols which develop easily.

Also

Pharmasol Brown GRNN

Yellower and brighter in shade

Better Wash Fastness

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451-453 Washington Street, New York City

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DURAND & HUGUENIN S. A.
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PHARMACINES

Representative: Los Angeles (Hathaway Allied Products)

AMERICAN DYESTUFF REPORTER

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MARCH 27, 1944

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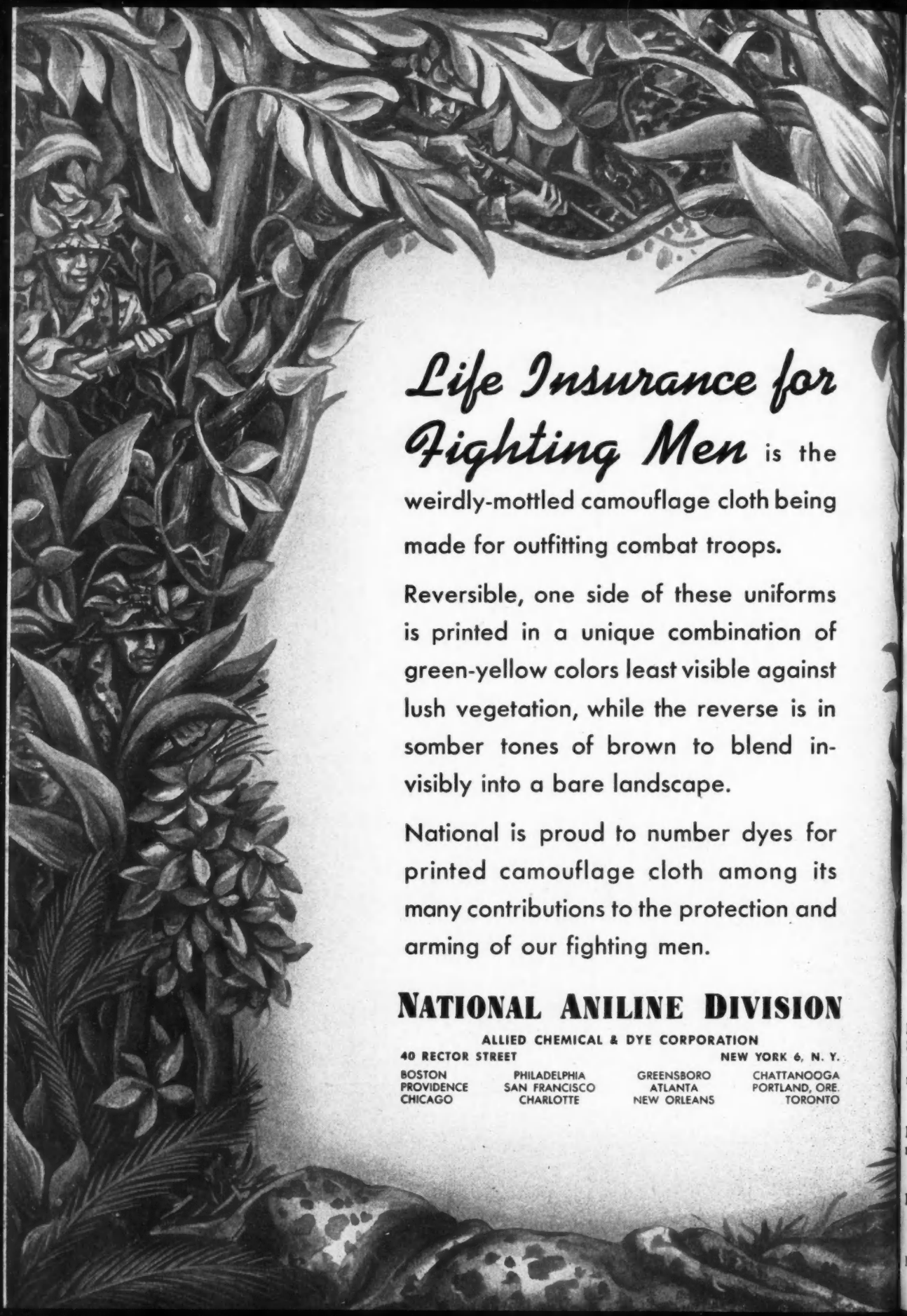

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Reversible, one side of these uniforms is printed in a unique combination of green-yellow colors least visible against lush vegetation, while the reverse is in somber tones of brown to blend invisibly into a bare landscape.

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NATIONAL ANILINE DIVISION

ALLIED CHEMICAL & DYE CORPORATION

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PROCEEDINGS OF THE

American Association of Textile Chemists and Colorists

MARCH 27, 1944

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CALENDAR OF COMING EVENTS

Meeting, Rhode Island Section, Providence Engineering Society, 195 Angell St., Providence, R. I., March 31, 1944. Speaker: D. J. Campbell, "Procedure and Equipment for Bleaching Cotton Goods with Peroxide Continuous Method."

Meeting, South Central Section, Read House, Chattanooga, Tenn., April 1, 1944. Speaker: W. M. McLaurine, "Crystal Gazing at the Post-War World."

Meeting, Philadelphia Section, Hotel Philadelphian, April 14, 1944.

Meeting, Council, New York City, April 21, 1944.

Meeting, New York Section, Downtown A. C., 19 West St., New York City, April 21, 1944. Speaker: Henry F. Herrmann, "Dyes and Chemicals in Post-War Planning."

Meeting, Research Committee, New York City, April 22, 1944.

Meeting, Southeastern Section, Atlanta Athletic Club, Atlanta, Ga., April 22, 1944.

MEETING, NORTHERN NEW ENGLAND SECTION

A REGULAR meeting of the Northern New Englan Section was held on Friday evening, January 2 1944, at the Hotel Manger, Boston, Mass.

There were 94 members present at dinner and approx mately 110 members were in attendance at the busine and technical session which followed. Also present we a number of mill officials, who were guests of the Associ tion.

At the business meeting, John N. Dalton, Councilor f this Section, submitted his report on the last Coun meeting. This was read and accepted.

At the technical session, Dr. Walter S. Landis, Vic President and Director of the American Cyanamid C spoke on "The Post-War Outlook for the American Che ical Industry." Dr. Landis gave an enlightening, vigoro and interesting talk on this timely subject. A questi and answer period followed.

At the conclusion of the technical session, Chairma Chapin called for a rising vote of thanks to Dr. Land for his splendid talk. The meeting was then adjourned.

Respectfully submitted,

A. W. MACK, *Secretary*

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MEETING, PHILADELPHIA SECTION

THE Philadelphia Section held their meeting on Mar 10, 1944, in the main auditorium of the Engineers Cl of Philadelphia, Pa.

William A. Wolhar, Rosemary Manufacturing Co., d livered a talk on "Screen Printing Cotton Table Damask which was followed by moving pictures showing the pro ess in detail. Actual samples were passed among th members for close observation and all questions we answered by Mr. Wolhar.

The War Department showed moving pictures wi sound effects called "Life Line."

There were 205 present which was one of the large turnouts for the Philadelphia Section.

Respectfully submitted,

A.E.RAIMO, *Secretary*

APPLICATION BLANKS

FOR INDIVIDUAL AND CORPORATE

MEMBERSHIP

MAY BE OBTAINED

FROM THE SECRETARY

Dr. H. C. Chapin

Lowell Textile Institute, Lowell, Mass.

ARALAC*

O. B. BROMLEY, JR.
Vice-President, Aralac, Inc.

THIS evening I thought I would tell you something of the reasons for National Dairy Products Corporation's initial interest in the production of a textile fiber from the casein of skim milk; a little concerning the developmental period in manufacturing the fiber we now call Aralac; outline a few of the reasons Aralac is welcomed in the textile field today; something about the present status of our staple; and a little about our future plans.

There are a few samples of fabrics and some knit wear containing Aralac in the blend on this table here and, if any of you would care to see them after the meeting, please do so. Mr. Carmichael in charge of dyeing and finishing in our organization is here this evening, and Mr. Fuller, our consultant on spinning and weaving is also present. If you have any questions, these men will be glad to try to answer them.

The production of milk on farms is so huge that it makes dairy farming the largest single source of farm income in this country. Naturally, the economic significance of the dairy industry in the economic pattern of American life is outstanding. Dairying has achieved this predominance in the agricultural field despite the fact that about half by volume of the total milk production of this country is used in its raw form for no other purpose than animal feed. Any development which can more effectively and profitably utilize a portion of this huge output of milk normally used for feeding animals would further increase the economic value of milk production . . . both to the 2½ million dairy farm families who produce the milk as well as the nation as a whole.

Consequently, when National Dairy learned that some steps were being taken by foreign fiber manufacturers to produce a textile fiber from skim milk, the executives of our organization immediately became interested. Our group realized that were a synthetic protein-base produced, it would have to be better than any produced abroad. To accomplish this, they asked Francis Clarke Atwood, who had long been interested in the research problem of developing a spinnable fiber from the casein of milk to undertake the job. Mr. Atwood commenced this phase of his work for National Dairy around 1936. A year or so later a pilot plant was in operation. By 1939 and early 1940 man-made protein base fibers were being sold on a semi-commercial scale to the fur felt and wool felt hat industry. Subsequently, the manufacturers of automobile fabrics—seat covers, head linings and side walls—became interested. Shortly thereafter, in the early part of 1941, National Dairy purchased the building that now houses its present plant at Taftville, Connecticut, and prepared to produce what we now know as Aralac on a commercial basis.

Pearl Harbor and the events immediately succeeding our nation's entry into the war naturally changed the merchandising plans of Aralac, Inc. The fur felt and wool hat manufacturers continued to buy Aralac staple as they had in the past, but naturally, with automobile manufacturing out of the picture, that market was temporarily closed for Aralac staple. However, the spinning and weaving mills interested in shirting, dress goods, suitings and coatings, wished to investigate the potentialities of our staple, and early in 1942 were buying in considerable volume. Since then the plant at Taftville has been producing with maximum capacity possible under present conditions.

There are several reasons why spinning and weaving mills were interested in sampling Aralac other than their natural interest in anything new.

In the first place, repeated tests have shown the fiber to be as warm as wool. These tests have been made both on a before and after use basis. One hundred per cent Aralac woven goods have been compared with 100 per cent wool goods made of the same grade of staple, same system of spinning, same size yarns and same constructions throughout.

Secondly, Aralac staple is unusually resilient for a man-made fiber. This resilience carries through into the woven cloth and helps the fabric in respect to its anti-crease and anti-wrinkle properties. A small admixture of Aralac in the blend with other synthetic or cotton fibers naturally will not create an anti-wrinkle fabric; a large admixture will, however, tend to produce that result.

Thirdly, there was no need to create and develop a new line of dyestuffs for use with Aralac blend fabrics. Aralac content goods will take the dyes now in the market and present no problem regardless of whether Aralac and wool, Aralac and viscose, Aralac and acetate, or Aralac and cotton or combinations thereof are in the fabric. Like

*Presented at Symposium on "Synthetic Fibers and Their Future Development" at meeting of New York Section, February 4th, 1944.

wool, Aralac will withstand carbonizing; a fact of interest to woolen manufacturers. Like wool, Aralac will not withstand the caustic boil-off to which carded cotton goods are often subjected. Therefore, in so far as cotton fiber is concerned, Aralac should be blended with either combed cotton or a carefully carded cotton stock which will result in a piece of greige goods relatively free of leaf or mote.

The feel or hand of Aralac goods can be varied depending on the grade of Aralac used in the blend. We are now selling 50's, 60's, and 70's grade, which are roughly equivalent to 7 denier, 5 denier and 3 denier respectively. Furthermore the hand of goods containing the same grade of Aralac can be modified, depending on the finishing treatment employed at the dye house. The surface can be made to range in sharpness from that of a worsted to the softness of a soft woolen.

The finer grades of Aralac when used 100 per cent in a fabric, without any other type of fiber, feel more like angora. No such fabrics are now on the market, and will not be in the immediate future, but garments of 100 per cent Aralac have been made and have been undergoing tests during the last several months. Further tests are planned in the future. The coarser grades of Aralac, namely, our 50's grade, more nearly resemble wool in hand than angora. Garments made from these are also undergoing tests at this time. These surface interest characteristics inherent in Aralac and the wide range of hand that can be put on an Aralac blend fabric through variation in grade and through manipulation in the dye house, and without need of resorting to special finishes, help create versatility in the use to which Aralac content goods can be adapted.

Currently, Aralac and its customers are still engaged in discovering the full range of usefulness of the staple. Thus far, cotton system spinners have utilized the major portion of our production, followed by woolen spinners, silk spinners and worsted spinners, in that order. Aralac is now being blended primarily with viscose rayon. The Aralac content ranges from 20 per cent to 50 per cent in the blend. During 1942, the average Aralac content in all Aralac fabrics approximated 28 per cent. Today the average is around 35 per cent.

Most of the fabrics produced have been for women's dress goods, suitings or coatings. However, the men's wear field has been represented in the sport shirts, robes and slacks field. Men's half hose and women's and children's anklets and underwear have consumed a fair portion of our production. No effort has been made to date to perfect a fabric suitable for men's wear tropical or year round suiting. The potentials of that field, however, are distinctly interesting.

Consumer's acceptance of Aralac content merchandise has been good. Apparently, the American women have been conditioned by American industrial research to be amazed at nothing. Consequently, the expression "fabric from milk" which originally appeared in department store advertisements all over the country in the middle of 1942 did not appear to deter her purchases. If anything, such phrases seemed to stimulate buying. Today Aralac appears to have become an accepted fiber in the minds of the average buyer. Naturally, she is not as well informed about synthetic protein-base fibers as she is on rayon or nylon, but the education of several million women throughout the country on the characteristics of any new textile fiber takes time.

To summarize, I might say that this man-made protein base fiber has found a real place for itself in the field of blended or manipulated fabrics. It has come into those types of market cloths where its characteristics indicated probable success with minimum experimental effort. The staple has not yet been fully exploited in many fabric fields where it may well be widely employed in the future.

I do not want any of you to assume from the foregoing that our first two years of operation have all been trouble-free and smooth sailing. We have had our bad moments, but fortunately they have all turned out to be minor troubles. Back in 1942, the problem of dyeing Aralac content goods loomed large. Many of you in this audience doubtless experienced plenty of difficulty in getting a good finish on the first Aralac goods you handled in your own finishing plant. I think those of you who are finishing Aralac fabrics currently will agree, however, that the problem of achieving a proper finish satisfactory to your customers was not difficult.

We also have had many problems up in our plant in ironing out mechanical and chemical kinks in our processing operations. The chief difference in our manufacturing process contrasted with the production of viscose or acetate rayon lies in the fact that about 95 per cent of the processing of protein base fibers occurs after the fiber has been extruded in semi-plastic form through the spinnerettes. In the production of rayon, extrusion through the spinnerettes occurs near the end of the manufacturing process. Currently, however, these initial difficulties lie behind us and we are devoting most of our research energies toward further improvement in the physical properties of the staple.

We are by no means satisfied to remain as a blending fiber only. We are working toward further improvement in physical characteristics of our fiber so that it can be spun and woven 100 per cent in fabrics. It now seems probable that announcements of some progress in this direction will be forthcoming shortly.

We are also interested in trying to provide a finer micron staple. Natural protein fibers available commercially in volume are limited in the really fine sizes. If we can perfect our synthetic protein base fibers in finer micron ranges, it might be possible to achieve new fabric effects not formerly considered possible in view of the characteristics of spinnable fibers now commercially available. I had hoped to be able to show you a few samples of fabrics spun from these new experimental grades of Aralac here this evening. Unfortunately, they are not yet ready.

BEMBERG*

E. H. BENZING
American Bemberg Corp.

I HAVE been asked to speak to you about Bemberg rayon made by the cuprammonium process.

The cuprammonium process of making rayon differs from the other processes which have been so ably described by the gentlemen who have preceded me here, in that the cellulose is dissolved in a solution of copper and ammonia.

The spinning solution is extruded through spinnerettes into water where a partial coagulation takes place. At this point, the filaments are drawn out to the desired fineness by a stretch-spinning device. Further coagulation is then provided by an acid bath.

The method of stretch-spinning as used in making our cuprammonium yarn permits the manufacture of exceedingly fine filaments such as 30/74, 35/60, 40/30, 65/45, 75/60, 100/75. Although the standard yarns now being produced are made with about 1.3 denier per filament (approximately the same as silk), it is possible to produce a thread having filaments of less than 0.5 denier in size.

The greatest portion of cuprammonium rayon production is used in the weaving trades. Among the fabrics made in this general category are drapery and upholstery fabrics, neckwear cloths, georgettes and chiffons, sheer dress fabrics, satins for underwear and dress goods, ninons, shirtings, linings, velvets and narrow fabrics.

In the knitting field are included tricot and Milanese underwear dress goods, and glove fabrics, circular knit underwear and full-fashioned and seamless hosiery.

At this point it should be mentioned that, in line with all of the rayon producers, strenuous efforts are being made to fit cuprammonium rayon into the war program, for use in certain types of flare parachutes, camouflage cloth, etc.

As you are probably aware, the W. P. B. requires all producers of viscose and cuprammonium yarns to set aside a certain portion of their production to be allocated to former uses of silk and nylon. Since the hosiery industry consumed the greater portion of these two fibers, which have been taken over by the government for war needs, it naturally follows that most of the rayon to replace them is being knitted into stockings.

Although rayon has been used in considerable quantities in the past by the seamless hosiery manufacturers, comparatively few of the full-fashioned manufacturers had any experience in handling this fiber. Such rayon full-fashioned hosiery as had been produced prior to the silk freezing order, was generally intended for the lower retail price brackets (69 cents per pair and lower). Due to strict cost limitations, the knitter was unable to improve his product beyond a certain point. When the hosiery manufacturers realized that silk and nylon were no longer to be had, costs were forgotten, generally, and efforts were made to produce as fine a rayon stocking as possible. The results have been interesting and gratifying. The first step taken was to increase the twist of the rayon. Up to this time most rayon stockings were made of yarns with from three to five turns per inch. The rigid price levels at which the finished hosiery had to be sold did not permit the knitter to increase the twist and thereby add to his cost of manufacturing. With this limitation removed, twists were increased up to 40 turns and more per inch. This had the effect of dulling the appearance of the stocking by breaking up light reflection and also increasing its sheerness by reducing the diameter of the thread. Higher twists also improve resistance to snagging. In this connection, it might be added that *better* rayon full-fashioned stockings being made to-day snag less readily than most of their silk predecessors. As for the effect of increased yarn twists on the elasticity or recoverability of the stocking, there does not seem to be as yet any definite agreement. Undoubtedly increased twist has some effect in this respect on the thread itself, but just how much of this added elasticity is transmitted to the knitted fabric is not easy to measure. While the elasticity or fitting quality of the stocking is probably improved by adding twist to the yarn, other factors, such as tightness of stitch and the gauge of the knitting machine also have an effect.

The adoption of higher twists for hosiery knitting was not without its problems, however. Not many full-fashioned mills are equipped to do their own twisting nor does the rayon industry generally possess the facilities to deliver high-twist yarn to the knitter. This function properly fell to the hosiery yarn throwsters, who, though lacking experience in handling rayon, put their whole efforts into solving the problem of delivering a satisfactory yarn to the knitter.

The chief difficulty encountered was that of finding a suitable treatment of the rayon yarn that would permit smooth knitting without kinking of the thread with resultant press-offs and loss of production.

*Presented at Symposium on "Synthetic Fibers and Their Future Development" at meeting of New York Section, February 4th, 1944.

In a comparatively short time, several treatments were developed which seem to have eliminated this particular problem.

Another serious problem for the full-fashioned hosiery manufacturer has been the available sizes or deniers of rayon. This can be readily understood when it is realized that the principal sizes used for leg yarns before the war were 2-thread, 3-thread, and 4-thread silk or 20 denier, 30 denier and 40 denier nylon.

No rayons of comparable fineness and strength are available to-day, the hosiery knitter, therefore, in addition to learning how to handle a fiber new to him, has to work with yarn sizes considerably heavier than those to which he has been accustomed.

The W. P. B. order covering silk and nylon replacement defines fine denier rayons as those of 300 denier and finer. When you consider that 300 denier rayon is equivalent to more than 20 threads of 13/15 silk in the gum (or more than 26 threads of boiled-off silk) it can be seen that 300 denier rayon does not have much of a place in the full-fashion hosiery field. The rayon industry has cooperated, however, by providing for hosiery the finer deniers wherever possible. The available poundage of the finer deniers which are preferred by the hosiery trade is, however, inadequate. This is shown by statistics for the year 1941 when less than 25 per cent of the rayon (other than acetate process) was 100 denier or finer of this quality, a certain amount (such as 50 denier high tenacity) is taken up by government priorities. Shipments of considerable quantities of these fine deniers are being continued to the weavers, the warp knitters, etc., for whose use they were developed. The remainder available for hosiery is therefore necessarily limited.

The problem of using heavier threads then were used in silk and nylon is somewhat lessened by the fact that rayon stockings seem to appear sheerer on the wearer's leg than they really are. Cuprammonium rayon, however, is spun in finer deniers than those generally manufactured by the other processes. At the present time the production scheduled embraces 30 denier to 100 denier inclusive.

The percentage of full-fashioned stockings in which 100 denier cuprammonium rayon is used as a leg yarn is very small. 75 denier cuprammonium rayon in twists 20-40 turns per inch is used for legs chiefly on 45 gauge machines.

Sixty-five denier cuprammonium rayon as a leg yarn is generally twisted from 30 to 40 turns per inch and finds its place in 48 and 51 gauge constructions.

These constructions give generally satisfactory wear. Because of the lower wet strength of rayon, the proper foot construction has come in for considerable discussion. Reinforcing the foot with cotton yarns is generally recommended, especially in the toe area. Proper foot size is very important, taking into consideration the foot size after the stockings have been laundered. Many hosiery manufacturers are now making this rayon merchandise in proportioned lengths for different types of wearers. This is an excellent idea, but is impossible of widespread adoption, unfortunately, because of the necessity of maintaining stocks of foot sizes and colors in each different length in the face of limited supplies of yarn.

Rayon stockings now being made can be expected to give fairly good wear results. The extraordinary wear of nylon hosiery can hardly be duplicated with current rayon stockings. When a comparison is made with sheer silk hosiery, however, the consumer will probably be pleasantly surprised. Reasonable care in handling and washing are, of course, important, but most of all, the stockings should be allowed to dry thoroughly before they are worn. To insure this, some manufacturers are advocating the wearing of their hosiery on alternate days, others are even suggesting a 48 hour drying period. The main thing to be remembered though is that rayon stockings are weakest when wet, and their full strength is not regained until they are completely dry.

At this point I wish to mention that Bemberg along with the other rayon manufacturers are experimenting with new yarns for post-war use.

No discussion of this type would be complete without a word of commendation for the hosiery industry. It found itself, with little or no warning, faced with one of the greatest problems in its history; with typical American ingenuity, determination and skill it is meeting the emergency.

APRIL MEETING, NEW YORK SECTION

DR. HERMAN E. HAGER, chairman of the technical program committee, has announced that Henry F. Herrmann of the General Dyestuff Corp. will be the principal speaker at the April 21st meeting, to be held at the Downtown Athletic Club, 19 West Street, New York City. Mr. Herrmann's subject will be: "Dyes and Chemicals in Post-War Planning." He is well qualified to survey this field in which most dyers, finishers and converters are intensely interested at this time. Mr. Herrmann is chairman of the publicity committee of the national association and has previously served the New York Section as chairman and as councilor.

The date of this meeting coincides with the 70th birthday of Dr. Louis A. Olney, president emeritus of the national association and chairman of its research committee. For this reason, the meeting has been designated as "Olney Night" and a few brief addresses outlining the accomplishments of the guest of honor are scheduled.

Reports will also be given on the Association's Research Program, the Intersectional Contest, and the National Convention to be held in the Fall.

ACCELERATED AGEING TEST

For Textiles Dyed with Sulfur Colors

TENTATIVE

Scope: The purpose of this test is to determine whether sulfur dyed textile materials will or will not deteriorate under normal storage conditions and the degree of such deterioration.

Apparatus: 1. Conventional laboratory drying oven[1], uniformly heated and controlled to ±2°C. It should be provided with ventilating ports and some means for introducing moisture.[2]

or

2. Steam Ager[3] equipped with proper controls for uniform steam flow and temperature.

Test Specimens: Suitable test specimens shall be taken and blanks of the same material, dyed and undyed, used.

Procedure: 1. The Oven Test shall consist of heating in the oven for 6 hours continuously at 135°±2° (275°F.±5°). At the beginning of the second, third, fourth, fifth and sixth hours the ports or vents shall be closed and 20 cc. of water added for each cubic foot of oven capacity. The vents are kept closed for five minutes, then opened and circulation resumed for the rest of the period. As an alternate the test specimens may be removed from the oven at the end of each hour and thoroughly humidified in an atmosphere of steam, then replaced in the oven. At the end of the six hours of heating, the specimens are removed from the oven and placed in a conditioning room, if available.

2. The Steam Ager Test. The test specimens may be suspended while ageing, or may be tacked on frames, which are then placed in the steam ager, pyramid style, with the bottom baffle functioning as a support. The specimens are aged for 8 hours with saturated steam at 15 lbs. pressure, or for 16 hours at 7½ lbs. pressure. After the ageing test is completed the samples are removed from the ager and placed in a conditioning room, if available.

Evaluation of Results: Breaking strength tests[4] are used to determine the degree of deterioration, although Cuprammonium fluidity may be used if desired. Test specimens and unaged blanks should be conditioned for 16 hours at standard conditions (65% RH & 70°F.) before making breaking strength tests.[5] A minimum of 10 significant breaks should be made and the results averaged. Results shall be reported as plus or minus per cent of the unaged material.

This standard procedure for determining the ageing properties of textiles dyed with sulfur dyes is the result of extended work done by the A.A.T.C.C. committee on accelerated ageing tests for sulfur dyed materials. This committee acted under the chairmanship of T. R. Smith. R. H. Souther has recently been appointed chairman to succeed Mr. Smith and will be pleased to receive comments upon this method. A report in regard to the work of this committee will be found in American Dyestuff Reporter *32*, P380 (1943).

NOTES

[1] The oven used may be of any conventional design and constructed of conventional materials as long as the heating elements or materials of construction do not give off gases when heated, which would tend to distort the results. The quantity of materials tested must bear a fixed relationship to the capacity of the oven, 25 grams of materials tested per cubic foot of oven capacity is considered correct.

[2] The temperature control must be accurate within 2° C., plus or minus. Care must be exercised to insure that the thermometer indicates the true and correct internal temperature of the area in which the samples are being tested.

The oven should be equipped with ports or vents of such size to allow the air in the oven to be changed approximately each two minutes except when humidifying. This may be accomplished by natural convection or by a circulating system. During humidification the ports or vents should be closed to confine the moisture within the oven for the specified time.

Controlled amounts of water (or steam) should be admitted into the oven at specified intervals. This may be entered through either the top or the side of the oven. The requisite amount of water should be added onto a heated mass of materials in order to effect rapid vaporization. To effect this relative rapid vaporization the weight of material should be approximately 100 grams for each gram of water admitted each hour. The amount of water admitted should be sufficient to cause the filling of the oven with steam at atmospheric pressure each hour. 20 cc. of water produces approximately 1 cubic foot of vapor at atmospheric pressure and at 135°C. (275°F.). In addition to the desired rapid vaporization of the water admitted, the mass of metal or other materials act as a temperature stabilizer and serves to prevent a sudden drop in temperature owing to the latent heat of vaporization of the water introduced. Ovens meeting the specifications of the A.S.T.M. for accelerated ageing of rubber, equipped with automatic humidity control, are acceptable.

Provision must be made for holding samples to be tested so that they will not come in contact with the hot metal portion of the oven. A suitable means is to hang the materials tested by strings from glass or wooden rods in a manner to assure their not coming in contact with each other or with the sides of the oven. Materials tested must be held in that part of the oven where the temperature is constant and uniform and where all portions of tested samples are exposed to the same temperature and the same conditions of humidity and atmospheric change.

[3] A typical steam ager consists essentially of a closed cylinder, 23" long by 15" diameter, inside measurement, one end of which is a swinging door. A groove in the face of the cylinder holds a gasket against which the door is held tightly by a lever clamp. The apparatus is equipped with a pressure gauge, automatic temperature recorder, steam inlet with handcock flow control valve, petcock, trap and baffle of thin stainless steel sheet metal in the top half to prevent dripping from condensation. A wooden frame,

22" x 14", covered with coarse cloth and supported by protruding bolts in the sides along the center, serves as a bottom baffle to prevent possible splashing. However any steam ager equipped with the proper controls for uniform steam flow and pressure may be adapted to this test procedure.

[4] Since comparative, but not absolute, results are to be obtained, any suitable breaking strength machine may be used which is adaptable to breaking the samples being tested.

[5] If possible, breaking strength tests should be conducted in an atmosphere of controlled humidity as described above.

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MEETING, MID-WEST SECTION

THE last meeting of the Midwest Section was held at Bismarck Hotel, Chicago, Ill., February 12, 1944.

The afternoon meeting was called to order by Vice-Chairman George Osha at 3:30. Charles Robbins, Chairman of the "Rumpus Committee," then presented a 7 point program as follows:

1. That a Registration Desk be set up at all future meetings for registration of members and suppliers. Carried unanimously.

2. That a committee be appointed to call on suppliers to close their rooms during meetings. Carried 41 yes, 7 no.

3. That the afternoon meeting start earlier so that an open forum may be held on the order of "Information Please." Motion carried 46 yes, 2 no.

4. That the Secretary write mill executives asking mill representatives (dyers and chemists) to attend meetings whenever the sectional committee thinks we have an outstanding program. Carried 43 yes, 5 no.

5. That secret ballots be held on election of officers or other subjects of importance. Carried 43 yes, 5 no.

6. That a "Rumpus Committee" be appointed to meet annually at the October meeting. Carried 47 yes, 1 no.

7. That an outing be held if the outing committee can find a suitable spot and date. Carried 40 yes, 8 no.

There were 50 members and guests present. There being no further business, the meeting adjourned at 4:45.

Dinner was served at 7:45 P. M. Eighty-three members and guests attended.

The business meeting was called to order by Chairman Virgil Hartquist at 8:30 P. M.

The Secretary's and Treasurer's reports were read and accepted.

The Nominating Committee composed of Arthur Barker, Chairman, Fred Wilhelm, Charlie Lennox, Louis Blank and Herman Stiegler were called on for their report. Fred Wilhelm read the nominations as follows:

Officers: Chairman, V. T. Hartquist; Vice-Chairman, George E. Osha; Treasurer, Alfred J. Olson; Secretary, Louis Hoehn, Jr.

Sectional Committee: A. G. Alexander, Herman Boxser, E. J. Siegrist, Eric Hempel.

Councilors: Herbert W. Tetzlaff, Arthur T. Brainerd.

Mr. Hartquist called for further nomination and there being no further nomination, the above mentioned were unanimously elected.

Various committees were then appointed.

Mr. Hartquist then introduced William D. Appel, President of the A.A.T.C.C. Mr. Appel gave a talk on the research committee and the aims and accomplishments of the Association.

A motion picture by the Signal Corps, U. S. Army, entitled "Learn and Live" was then presented.

Meeting adjourned at 10:45 P. M.

Respectfully submitted,

LOUIS HOEHN, JR., *Secretary*

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MEMBERSHIP APPLICATIONS

Senior

John Leslie Anderson—Supervisor of Dyeing, Franklin Process Co., Providence, R. I. Sponsors: A. R. Fletcher, R. W. Joerger.

John N. Baccash—Technical Executive, Frank Ix & Sons, Inc., New York City, N. Y. Sponsors: T. F. O'Brien, P. J. Kennedy.

Bowman W. Bacon—Master Dyer, Morgan Dyeing & Bleaching Co., Rochelle, Ill. Sponsors: L. Hoehn, Jr., B. H. Sharman.

Byron N. Baer—Research Chemist, American Viscose Corp., Marcus Hook, Pa. Sponsors: C. Schlatter, R. R. Smith.

Harvey S. Barnes—Foreman of Dye-House, Holeproof Hosiery of Canada, London, Ontario, Canada. Sponsors: E. J. Siegrist, L. Hoehn, Jr.

William F. Bartelt—Supt., Hart & Foster Co., Philadelphia, Pa. Sponsors: C. B. Wood, C. Baeringer.

Forrest M. Batson—Engineering Service, General Chemical Co., New York City, N. Y. Sponsors: J. E. Loughlin, C. C. Knights.

Theodore H. Boss—President, Brook Chemical Co., Clifton, N. J. Sponsors: L. J. Dogin, T. F. O'Brien.

Austin J. Brosnan—Textile Chemist and Colorist, Sandoz Chemical Works, Inc., New York City, N. Y. Sponsors: T. F. O'Brien, H. C. Hennig.

John W. Byam—Chemist, Sayles Finishing Plants, Inc., Saylesville, R. I. Sponsors: P. J. Ariente, H. C. Allen.

E. W. Carlson—Research Chemist, Stanco, Inc., Elizabeth, N. J. Sponsors: E. H. Schmidt, N. A. Johnson.

Charles J. Chaban—Research Development Chemist, The Landers Corp., Toledo, Ohio. Sponsors: R. H. Schweibert, S. Glasberg.

William M. Cherry—Supt., Advance Piece Dye Works, Rutherford, N. J. Sponsors: L. J. Dogin, T. F. O'Brien.

John C. Chilton—Head Dyer and Chemist, Amos Hosiery Mill, High Point, N. C. Sponsors: R. H. Smith, J. W. Van Loan.

William F. Cockrell—Chief Dyer, The American Thread Co., Bristol, Tenn. Sponsors: R. W. Freeze, J. Anderson.

TRADE NOTES • NEW PRODUCTS

OBITUARY

DR. JAMES BRODBECK

DR. JAMES BRODBECK, President and Chairman of the Board of the Society of Chemical Industry in Basle ("Ciba"), Basle, Switzerland, died suddenly Sunday, February 20, at his country home in Gstaad, near Berne, Switzerland, at the age of 61.

Dr. James Brodbeck

Dr. Brodbeck joined the staff of Ciba in Basle in 1906. He was instrumental in organizing its branches throughout the world and in acquiring the various Ciba plants in countries outside of Switzerland. He was also a Director of many other corporations in Switzerland, and of many of the Ciba organizations.

Dr. Brodbeck had traveled extensively in the interest of Ciba, and leaves a host of friends all over the world. He is survived by his wife and his son, J. J. Brodbeck, President of the Ciba Pharmaceutical Products Corporation of Summit, N. J.

• CALCO TECHNICAL BULLETIN

A recent technical paper on modern English textile finishing equipment written by K. S. Laurie of John Dalglish & Sons of Glasgow, has been reprinted by Calco Chemical Division, American Cyanamid Company in the Calco Technical Bulletin No. 751, entitled, "Some Textile Finishing Machines." Copies will be mailed upon request to the office of the Advertising Department, Bound Brook, N. J.

• MEETING, TEXTILE TECHNOLOGISTS

The speaker for the April 5, 1944, meeting of the American Association of Textile Technologists will be N. M. Mitchell, Barnes Textile Associates, Inc., Boston, Mass., whose subject will be "Engineering with Relation to Modern Textile Machinery."

• WOMEN'S WORK CLOTHES

For combined practicality and good appearance in women's work clothes, industries in many fields of war service are choosing fabrics with viscose rayon content, it is stated by Du Pont. Almost without exception, industrial requirements for garments of this kind call for commercial launderability, durability, vat-dyeing and controlled shrinkage. Comparative tests in plants are said to have shown that after repeated washing, rayon-containing fabrics do not "fuzz up" as much as all-cotton garments but retain their original attractive texture.

• CORRECTION RE JOHN HARLEY

Through an error in the 1943 A.A.T.C.C. Year Book listing of "Men in the Armed Forces" it was indicated that John A. Harley was deceased. It is a pleasure to report that he is very much alive; has become an Ensign in the Navy and is now serving somewhere in the Pacific.

• KEEP CONTAINERS IN CIRCULATION

Through carelessness or hoarding there may not be enough cylinders and drums for transporting ammonia. Idle cylinders and drums may mean delay in meeting a war need. Order in quantities for immediate requirements only and return containers for refilling as quickly as possible.

• ASST. RESEARCH DIRECTOR

Philip J. Ehman, a research chemist with Ansul Chemical Company, Marinette, Wisconsin, for the past eight years, has been named Assistant Research Director, according to an announcement made by H. V. Higley, the firm's president. The appointment took effect February 7, 1944. Mr. Ehman received his B.S. degree in 1943 at the age of twenty from Montana State College and three years later earned his Ph.D. degree at the University of Chicago. He joined the Ansul research staff in May, 1936.

• PURPLE HEART

The Order of the Purple Heart has been posthumously awarded to Second Lt. W. W. Highberger, of the Chemical Warfare Service, U. S. Army, who was reported missing in action in the European theatre a year ago and is now listed as lost in action. Lt. Highberger received his commission in September 1942, while he was associated with The Mathieson Alkali Works.

ZINC OXIDES IN SMOKE SCREEN

According to a booklet prepared by the New Jersey Zinc Company, the distribution of particular grades of zinc oxide to their customers has been curtailed somewhat because of its use by the Government in preparing smoke screen. Smoke chemicals, when released, create dense volumes of smoke for screening operations in the field or at sea. The movement of troops, building of pontoon bridges across rivers and the establishment of bridgeheads are effected with less casualties if a smoke screen is used during operations. One of the methods used to create an artificial fog effect involves the use of a zinc material with some type of organic chloride compound. The reaction results in minute particles of zinc chloride. This material absorbs moisture from the air, producing a fog or cloud which is the screen. According to the New Jersey Zinc Co., the zinc material which the Chemical Warfare Service is finding ideally suited to this type of smoke screen, designated as "HC Mixture," is zinc oxide. Shown in the photograph to the right is a smoke screen over an Italian Harbor.

Official U. S. Army photograph.

The Preparation and Properties of

SULFONATED PEANUT OIL*

JOHN B. GALLENT[1]
Georgia Experiment Station, Experiment, Georgia

DURING 1939 some experimental work was done by the writer on the sulfonation of peanut oil. The work was taken up by the Georgia Experiment Station in the summer of 1940. Since this study was initiated our source of supply of many oils commonly used as raw materials has been cut off, or greatly curtailed by war conditions. At a part of the effort to meet the increased demands for domestic fats and oils farmers were asked to increase their peanut planting for oil crushing in 1942 to about 5 million acres. The yield of oil from this should have been about 1 billion pounds of oil. On account of this situation it has been necessary to examine all domestic oils as to their immediate availability and possible application in many new and diverse fields.

Göllner[4] mentions peanut oil in a general study of oil sulfonation. Lloyd[7] stated that peanut oil should only be used in self-contained works where the period from raw to finished product is relatively short, but should not be used where the period of storing is an unknown factor. Burton and Robertshaw[2] mention peanut oil in a list of miscellaneous oils suitable for sulfonation and Pingree[8] lists peanut oil as a minor source of soluble oil for textile use. This brief summation of the literature shows that little information on the sulfonation of peanut oil is generally available.

Since sulfonated oils have many outlets (textile industry, paper industry, pine oil emulsifier, cosmetics, etc.) it is not possible to lay down a set of specifications to be generally applicable but each user must determine in advance, often by trial and error, what properties his process demands of an oil. There are, however, certain specifications which should be met by an oil that is to be used by sulfonators; these are (1) availability; (2) a not too variable price structure; (3) it should lend itself to the commonly practiced methods of refining, bleaching and de-odorizing; (4) it should contain a relatively large amount of oleic acid; (5) it should not develop or possess undesirable odors; and (6) it should not become rancid or cause stains if applied to textiles.

ADVANTAGES AND DISADVANTAGES OF PEANUT OIL

The following advantages and disadvantages possessed by peanut oil as a raw material for sulfonation have been observed by us or reported to us by sulfonators. It may be pointed out here that these observations were made late in 1939 and in the summer of 1940 and some of them are not of as much consequence now as at that time.

Desirable Qualities Believed Possessed by Peanut Oil

1. Ease of sulfonation.
2. Light color of oil.
3. Domestic origin.
4. High oleic acid content.
5. Bland properties of refined oil.
6. High saturated glyceride content. (For certain types of softeners.)

Disadvantages of Peanut Oil

1. The sulfonated oil clouds easily on standing.
2. High linoleic glyceride content.
3. High saturated glyceride content.
4. Too much odor except in case of refined, de-odorized oil.
5. Is a poor lubricant.
6. Tendency to oxidize and become rancid during storage.
7. Formation of a heavy emulsion during washing of sulfonated oil.

One sulfonator thought the titer too high while another thought it too low which may be another indication of the extremes in properties which sulfonators demand of an oil.

In the laboratory studies of sulfonation here reported, refined, bleached, de-odorized peanut oil was used. Sulfonation was conducted by adding from a dropping funnel an amount of 98 per cent sulfuric acid equivalent to 25 per cent of the weight of the oil used. The acid was added at the rate of 25 grams in 15 minutes. The oil was stirred by a motor stirrer during the addition and the mix cooled by surrounding the reaction vessel with ice or ice-salt mixture. The temperature was held between 20°-25° C. All samples were kept in contact with acid for 4 hours.

Washing with a weight of water equal to the weight of oil used and followed with the same weight of 15 per cent sodium sulfate caused an immediate separation of saturated fatty acids. (Peanut oil contains about 52.0 to 60.0 per cent oleic glycerides and about 20 to 25 per cent linoleic

* Presented before the Division of Agricultural and Food Chemistry at the 103rd meeting of the American Chemical Society, Memphis, 1942.

glycerides and about 18 to 22 per cent saturated glycerides[6].)

When the mixture was washed once with a 15 per cent solution of sodium sulfate this separation did not occur. Washing was accompanied by the formation of a very heavy emulsion. This emulsion is easily broken by adding a small amount of the 15 per cent sodium sulfate solution. A portion of the weighed salt solution should be saved for this purpose. Washing in the laboratory process usually required 8 hours for good separation.

"Fractionated" peanut oil prepared by T. A. Pickett of this Station by methods described by Hilditch[5] and that remained clear and bright at 0° C. for 24 hours was sulfonated. This oil produced a clear product completely soluble in cold water that showed only slight separation of saturated fatty acids after 3 months. This oil will, of course, be of laboratory interest only until "tailoring" oils by some similar process make it available in large amounts.

All products were neutralized with 20 per cent solution of NaOH. In each case clearing of the oil started at pH 4.9-5.0.

Sulfonation was also conducted using fuming sulfuric acid, with a mixture of fuming sulfuric (40 per cent) and sulfuric acid (60 per cent), and with chloro-sulfonic acid. The use of fuming sulfuric cut down on the time needed for sulfonation but increased the time required for washing due to formation of emulsions not easily broken as those formed when sulfuric acid was used alone. The mixture of sulfuric and fuming sulfuric acid was the best sulfomating agent used in laboratory work. It is of doubtful use in the industry. Chlorosulfonic gave rise to emulsions of high viscosity and yielded a product of intense red color and high viscosity.

The oils produced by sulfonation with concentrated sulfuric acid produced a clear solution in warm water but on standing this changed to an emulsion. Boiling a 10 per cent solution of the oil for 10 minutes caused no break-out of oil. The saturated glycerides separated on standing and gave the oil a rather bad appearance. If the pH of the oil is carried to 6.5-6.9 during neutralization the product is a heavy semi-paste in which separation of saturated glycerides is less marked but will occur over a long period of storage. A year-old sample so prepared showed definite separation.

In the case of oils prepared with the sulfuric-fuming sulfuric mixture the product was more soluble, formed clear solutions in cold water that did not break out on boiling nor form emulsions on standing. The percentage of organically combed SO_3 was slightly higher in all cases where fuming sulfuric was used. Table I shows active ingredients in two typical oils. The methods of analysis and the method of calculating the total active ingredients were based on those recommended by the Sulfonated Oil Manufacturers Association.

In order to improve the appearance and to reduce the possibility of rancidity several blended oils were prepared. Peanut oil was mixed with other oils and sulfonated by the same procedure as outlined above. The best appearing product was prepared by using a mixture of 75 per cent peanut oil and 25 per cent castor oil. It is clear and water soluble. Although saturated fatty acids did separate on standing the separation was not as bad as in 100 per cent peanut oil.

TABLE I
Total Active Ingredients in Sulfonated Peanut Oil

Sulfonating agent	98% H_2SO_4	98% H_2SO_4 60 parts Fuming H_2SO_4 40 parts
Combined SO_3	4.9%	5.5
Total Fatty Matter	60.57	48.44
Total Alkali (MgKOH/gram)	8.68	7.18
Total Sulfated Fatty Matter (Calc.)	67.00	57.00
Total Active Ingredients (Calc.)	67.34	57.28

BEHAVIOR OF OIL ON CLOTH

In order to study the behavior, *i.e.*, development of odor, stains, and softening qualities, a standard sizing mixture was prepared having the following composition: H_2O—1,000 grams, corn starch (40 fluidity) 60 grams, oil (50 per cent fatty matter) 50 grams. The size solution was cooked at 100° C. for 30 minutes, cloth (cotton drill) was then run through the size mixture, run through squeeze rolls and ironed with an electric ironer. The amount of oil used was in excess of the amount needed for softening. The excess was used to hasten possible development of odors or stains. The treated samples were placed in screw-cap jars and kept at 50° C. for 7 days. The samples were inspected for rancidity, odor and stain at the end of this period and the results summarized in Table II. Samples 4 and 5 contained soybean lecithin in an amount equivalent to 0.25 per cent of the total fatty matter; this was added to act as an inhibitor of rancidity.[3]

TABLE II
Effect of Heat Test on Cloth Treated with Peanut Oil

Sample	*Odor*	*Stains*
1. 100% peanut oil treated with 60-40 sulfuric-fuming sulfuric mixture	None	None
2. 100% Peanut oil treated with H_2SO_4	None	None
3. Year-old sample treated with H_2SO_4	Slight	None
4. No. 3 with 0.25% lecithin added	None	None
5. Commercial product containing 70% peanut oil and 30% castor and 0.25% lecithin	None	None

MILL TEST

In a mill test on blue denim 22 pounds of a commercial mixture (similar to No. 5 except for higher fatty matter content) were used in 100 gallons of size mixture. This amount of oil compared with 30 pounds of oil previously used by same mill. Each oil contained 67 per cent fatty matter. The cloth was run over 36 "dry-cans" at 8 pounds pressure. The cloth was then Sanforized at a rate of 27 yards per minute at 80 pounds pressure. At the end of the process no odor had developed. The cloth was stored 4 weeks without the development of odors. The cloth had

(Concluded on page 156)

WATER-VAPOR PERMEABILITY
of Certain Coated Fabrics

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Southern Regional Research Laboratory, New Orleans, Louisiana
Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture

SUMMARY

A new and practical concept is presented of the cooling effect afforded by waterproof garments when certain types of coatings are employed. Coating materials to be suitable for this purpose should have a relatively high permeability for water vapor while preventing the passage of liquid water. The results presented indicate that several synthetic resins and cellulose derivatives should be satisfactory if they are not specifically compounded to make them too highly water resistant. As an aid in such work the well known permeability cup test has been simplified to a method which does not require highly specialized or unavailable equipment, or an undue amount of the operator's time. It is shown to be amply accurate for the present purpose but subject to further refinement for testing the permeabilities of packaging materials, and other moisture resistant coatings that are especially compounded for low water permeability. By means of this test it is shown that the permeability to water vapor of uncoated cotton broadcloth, for instance, is reduced surprisingly little by application of a coating which withstands the 50-cm. hydrostatic pressure A.A.T.C.C. test.

THE coated rainproof and waterproof fabrics now being made for the armed forces and to some extent for civilians are in several ways an improvement over the former rubberized fabrics. Rubber, because of its relatively low price, so monopolized this field until a little over two years ago, that the general tendency was to look for more uses for rubber rather than to pay adequate attention to the possibilities for improvement by replacing it with some of the synthetic elastomers. It is true that special modifications and adaptations of the materials, as well as of the methods of application, have been necessary in order to give these synthetics the prominence which they now enjoy. The change to the superior "substitute" material, therefore, had to be actuated by the present scarcity of rubber.

The advantages derived from the use of the vinyl polymers, principally the chloride-acetate copolymer and the polyvinyl butyral, consist chiefly in their better aging quality and the fact that they can be made more resistant than rubber to grease and oil. They have also lent themselves to the development of a light coated fabric, requiring relatively little coating material, which permits a rather large amount of water to be evaporated through the cloth. The outside surface of such fabrics may be treated to shed water and in that case does not let appreciable amounts penetrate to the coating on the inside surface. Thus this fabric, while it transmits a certain amount of water vapor, prevents the passage of liquid water, even under hydrostatic pressure up to 50 cm. (approximately 20 inches of water, American Association of Textile Chemists and Colorists test[3]). This behavior is sometimes referred to as being due to ventilation through the cloth.

In the course of work at this Laboratory on the uses of certain synthetic coating materials, it became necessary to find a reliable test for the rate of water vapor transmission of coated fabrics. Tests with the Densometer in which air is pushed through a given area (0.1 square inch) of the cloth by a constant load (5 ounces) showed that the passage of air is too small to carry any appreciable amount of water vapor with it. Special precautions had to be taken to avoid any leakage past the seal around the Densometer orifice. In the case of garments any actual ventilation in service would, therefore, depend on the exchange of air by a sort of bellows action through neck, sleeve, leg, and other openings. According to Gregory[11] this is almost equally true of uncoated cloth garments.

The plastic coatings on a commercial waterproof material which is advertised for its ventilating properties, as well as those made at this Laboratory, are seen under the microscope to be somewhat discontinuous, inasmuch as the crossing points of the yarns appear to protrude through the coating. The air permeability tests, however, show that not enough air can pass through such a cloth to provide an appreciable degree of ventilation, particularly in competition with the air exchange through the openings of a garment.

Gregory [11] has shown that plain fabrics of varying textures, which differed as much as 2300:1 in their permeabilities to air, had a variation at most of only $\pm 6\%$ in their permeability to water vapor. Similar data are given by Black and Matthew[6]. Our results have shown, in addition, that fabrics may be coated and made waterproof in such a manner that they pass the American Association of Textile Chemists and Colorists hydrostatic pressure test[3] and still retain from 65% to 90% of their water-vapor permeability.

From the foregoing it would appear that water-vapor transmission through the coated fabric must take place

by absorption by the coating material as well as the fiber on the high-humidity side and evaporation from the other surface, exposed to lower humidity. The well known fact that the permeability to water vapor is not always found to be proportional to the water absorption is no contradiction to this hypothesis, since the amount of water absorbed by the coated fabric is only one of the factors which determine its rate of transmission. The other main factor is mobility, that is the speed with which the water molecules are passed on from one active (polar) group to another. Very little is known about this factor. The passage of the water molecules is, however, definitely not by free diffusion through molecular interstices. If such were the case, the rate of passage would have to be inversely proportional to the square root of the size of the molecules, according to Graham's law of diffusion. This law does not generally apply to the passage of gases through membranes. The relatively very large carbon dioxide molecules, for instance, pass very much faster through rubber membranes than do the very small hydrogen molecules.

The rate of travel of water vapor through plastic sheets and paint films is generally conceded to be inversely proportional to their thickness. Payne[16] has not found any deviation from this proportionality when using glass cloth to support his paint films and taking the weight of paint per unit area as a measure of the average film thickness. The glass cloth obviously plays no measurable part in the transfer mechanism. Our results (see Table II and Figure 2) indicate that with cotton fabric supporting the resin film, there is an inverse linear relationship, shifted from direct proportionality. This is, of course, due to the constant part played by the cotton cloth in the passage of the moisture. The fact that this inverse linear relationship exists constitutes, however, further evidence in favor of the assumption that the mechanism of water vapor passage through plastic coatings is one of absorption and diffusion in the solid state by what may be called adsorptive processes.

In the experimental part of this paper it is shown that the water-vapor permeability of broadcloth and presumably of some other cotton fabrics is reduced only 10% to 35% by suitable coatings which prevent the passage of liquid water under a head of 50 cm. pressure and of any appreciable amounts of air. The water passed in the form of vapor under the conditions of the test which is recommended, amounts to approximately one-half ounce per square yard of coated cloth per hour.

RESULTS

All essential tests have been made on 156 x 84-count broadcloth weighing 3.5 ounces per square yard. Prior to coating, this fabric was given a permanent water-repellent finish with "Zelan." Two, or more frequently three, coatings of ethyl cellulose were applied with a round edged blade, using considerable pressure against the cloth which rested on a solid metal backing. Best results were obtained with a coating dope containing 15 to 20% high-viscosity ethyl cellulose and an equal weight of dibutyl- and dibenzyl sebacate as plasticizers. The solvent consisted of four parts benzene and one part methyl alcohol. This permitted the production of coated fabrics that pass the American Association of Textile Chemists and Colorists hydrostatic pressure test[3] with as little as 13% take-up of the resin and have a desirable handle and appearance. Heavier coatings could be produced by increasing the concentration of the dope and reducing the pressure of the blade on the cloth. Above a concentration of 22% the viscosity of the ethyl cellulose dope became too high for proper handling. After coating, all swatches were dried at 120° to 125° F. (approximately 50° C.) for several hours.

Comparative permeability determinations were made on commercial vinyl resin-coated fabric with a count of 148 x 68. This had a resin take-up of approximately 19% as determined by extraction with solvent. This also just passed the 50-cm. hydrostatic pressure test. Other comparative tests have been made on swatches coated experimentally with a number of other synthetic resins and cellulose derivatives. As far as this work has been pursued the results fall in line with those on ethyl cellulose and vinyl resin coatings and conform to the known fact that cellulose-derivative coatings have generally the higher water-vapor permeabilities.

The permeability values for the uncoated fabrics as well as the rate of evaporation from an open cup, under the conditions of the test, are shown in Table I. It is seen from this table that the rate of evaporation is cut approximately in half by interposition of the cloth, and also that the water-vapor permeability of various fabrics does not differ greatly. This fact is borne out for fabrics of much more widely varying construction by Gregory[11] and Black and Matthew[6]. For equal thickness, the permeability of the vinyl resin coating is approximately 30% less than that of ethyl cellulose. The permeability values reported in this paper are not necessarily an accurate indication of those which would be obtained with commercially compounded coating dopes from either ethyl cellulose or the various vinyl resins. They should, therefore, not be regarded as showing the comparative merit of these resins for coating fabrics.

The permeability values for various thicknesses of ethyl cellulose coatings are given in Table II. The coating thickness is measured by the amount of resin applied to the cloth per unit area, calculated in percent. These values are expressed graphically in Figure 2, together with some of the data from Table I. They show that a linear relationship exists between the percent resin applied and the permeability. The absence of an inverse proportionality which has been shown to exist for paint films and plastic sheets, is explained by the constant but unknown part which the cotton fabric plays in the passage of the water vapor through the coated cloth.

Unit of Measurement: For the purposes of this investigation the permeability values have been expressed in

TABLE I
Permeabilities of Various Fabrics*

Type	*Count*	*Treatment*	*Water vapor passage Grams/sq. meter/hour*
Broadcloth	156 x 84	Zelan treated, ethyl cellulose coated (16.9% take-up)	14.0
Broadcloth	148 x 68	Zelan treated, polyvinyl chloride-acetate coated (19% take-up)	10.2
Broadcloth	156 x 84	Desized	15.7
Broadcloth	156 x 84	Desized, Zelan treated	15.3
Broadcloth	156 x 78	Commercial finish	14.9
Broadcloth	140 x 64	Commercial Finish	15.8
Print cloth	80 x 80	Commercial finish	17.1
Open cup (no cloth)			32.1

* The construction differences of the fabrics listed in this table are believed to be insignificant, since fabrics which have widely varying air permeabilities have practically the same permeability to water vapor.[13]

TABLE II
Water-Vapor Permeability of Ethyl Cellulose Coated Broadcloth

Thickness Percent take-up	*Permeability Grams/sq. meter/hour*
13.1	14.1
14.4	14.1
15.6	14.6
15.8	14.3
16.9	14.0
18.1	13.3
20.2	13.3
22.0	13.0
23.3	13.5
26.4	13.2
30.7	13.3
33.7	12.9
36.8	12.7
42.9	11.6

TABLE III
Permeability Conversion Factors

One gram/square meter/hour is equal to:	*Used by:*
0.02778 milligrams/second/1000 square centimeters	Gregory[11]
0.1 milligram/square centimeter/hour	Edwards and Wray** and Lishmund and Siddle[14]**
1.55 grams/100 square inches/24 hours	Levey[13]
2.4 milligrams/square centimeter/24 hours	Payne[10]**
24 grams/square meter/24 hours	Charch and Scroggie[8], Oswin[15], and A.S.T.M.[5]
0.295 ounces/square yard/24 hours	

* Most values reported as impedance, which is the reciprocal of permeability.
** Values are calculated per millimeter of film thickness.

grams per square meter per hour without regard to thickness. This is the same unit as used by the National Bureau of Standards' investigators[12, 17] in their work on paint films. The values expressed in this metric unit can be readily converted to ounces per square yard per hour for better visualization by dividing them by 33.9.

In order to facilitate the conversion of permeability values obtained by other investigators, including those of the A.S.T.M. method[5] for plastic sheets, most of which are in the metric system, the pertaining permeability units, together with their conversion factors, are compiled in Table III.

TEST METHOD

There is considerable literature on the permeability of cloth, paints and plastic films to air and water vapor. Air permeability tests such as that by the Densometer and the currently proposed American Society for Testing Materials Tentative Standard[4] for textile fabrics (parachute cloths, etc.) are unsuitable for coated fabrics because of the very small amounts of air which are passed after a coating is applied to the fabric. As indicated before, the amount of air which can be passed by coated fabrics having a sufficient degree of waterproofness to comply with the American Association of Textile Chemists and Colorists hydrostatic pressure test[3], is insignificant for the pressure purpose.

Most water-vapor permeability test methods use some form of the so-called permeability cup, that is, an open dish with some arrangement for fastening membrane over it. Test procedures have been devised particularly by the National Bureau of Standards[17] for blankets; by Gregory[11] and Black and Matthew[6] for uncoated fabrics; by Payne[16], Gardner[10], the National Bureau of Standards[12], and Lishmund and Siddle[14] for paints and synthetic resins; and by Charch and Scroggie[8] and the American Society for Testing Materials[5] for plastic sheet materials.

Paints can be tested by applying them to the parchmentized paper or to Fiberglas cloth. The methods developed for this purpose, as well as those worked out for plastic sheets, might appear to be also suitable for coated fabrics, but this is not exactly the case. As far as is consistent with the required mechanical properties, paints and plastic sheets are generally so formulated that they pass the lowest possible amount of water vapor. The test required for this purpose must lend itself to a considerably higher degree of accuracy than is necessary for testing coated fabrics, for which a certain permeability to water vapor—although not to liquid water—is desirable.

The construction of a suitable test cup for the more exacting types of permeability tests presents a considerable problem. It would seem that work along these lines has been to some extent impeded in the past by the complications of these tests.

The effect of random experimental variations can be eliminated by averaging the results of a large number of tests. Oswin[15] in his recent work on plastic sheets has used the average of 50 to 60 tests. This would seem to go considerably beyond the number needed to eliminate the effect of flaws and variations in the material being tested.

Increasing the number of tests cannot eliminate the effect of systematic errors, such as edge leakage or other improperly chosen test conditions. It becomes necessary, therefore, to determine very carefully the effect of any uncontrollable factors in order to be sure that the test is suitable for the purpose for which it is intended. If large systematic errors are avoided, a rather rough test will suit most purposes. It can then always be refined by merely increasing the number of tests made on any one material. The results reported in this paper are averages of three individual tests except those in Tables IV, V and VIII.

The type of test which we have undertaken to work out is intended to require the least possible amount of the operator's time and no very specialized apparatus. It may in this way become a more useful research tool for relatively highly permeable membranes than a highly accurate, painstaking test procedure. Experience with the present method of test has indicated that, where higher accuracy is required than was necessary for the present work, further improvement can readily be made by setting the dishes into a constant-temperature and -humidity oven with a regulated, relatively high rate of air circulation. A set of retaining rings with slightly varying diameters to accommodate different fabric thicknesses could also be provided to overcome the necessity for any protrusion of the ring over the fabric surface. The use of waxes to seal the edge is inadvisable because of possible wick action of the cloth fibers.

Test Conditions: After reference to previously used methods and some experimentation with drying agents, it was decided to use a saturated atmosphere over water in the cup and simply place this in a regular constant-temperature and -humidity room for textile work (70° F. ± 2° F. and 65% relative humidity ± 2%). A perforated hood of cardboard was placed over the test cups to avoid irregularities arising from stray air currents, but even with this precaution it was found necessary to run the tests over night, when the room was not occupied. According to Abrams and Chilson[2] such a test can be accelerated by exposing the cups to air moving at 200 to 600 feet per minute. Lower air velocities are liable to give erratic results. The American Society for Testing Materials method[5] prescribes a minimum air speed of 500 feet per minute over the exposed surfaces of the samples. For our present purposes the exposure over night in undisturbed air was, however, considered satisfactory, particularly because it did not require any special apparatus.

The humidity drop through the cloth from saturation to 65% relative humidity is thought to duplicate the service conditions of a protective garment as nearly as this is conveniently possible. The coated side was exposed to the higher humidity although tests showed that reversal of the cloth had no appreciable effect on the results obtained.

The temperature of 70° F. is probably below that of average service conditions for waterproof garments. A higher temperature would have served to accelerate the test and temperatures around 100° F. have been used by other investigators. There is, however, insufficient evidence to decide whether such temperatures duplicate service conditions any better. It is quite impossible to test coatings for all service conditions by using any one testing temperature. Moreover, since the testing procedure is presumably applicable to higher or lower temperatures without any essential change, the conditions which we have chosen serve as well for a starting point as any others which could have been selected. For a comprehensive investigation, tests at other selected temperatures must be added, according to the use for which the fabrics in question are intended. Interesting and detailed discussions of testing conditions and factors influencing the test are given by Adams and Brabender[1] and Carson[7].

Test Cup: The permeability cups for the present test are made from standard 3½ x 2-inch aluminum weighing dishes or boxes for moisture determination. These are available from several apparatus supply houses and are the largest which can be placed on the pan of a regular analytical balance. The cross section is slightly under 10 square inches (60.14 square centimeters) and they weigh less than 100 grams when fully loaded. The dishes were cut off on a lathe to an outside height of 1⅜ inches (1-5/16 inches inside). When 50 ml. of water are poured into the cup, the water level comes to one inch below the cloth stretched over the top. In order to fasten this cloth, the cut-off rim is slightly expanded to a somewhat conical shape, 3½ inches in diameter at the upper edge and 3¾ inches in diameter at the lower edge.* It will be approximately 9/16 inch high. The cup and retaining ring are shown in Figure 1.

The cover of the weighing dish could be used in this test in the same manner as was intended on the original weighing dish, by leaving the upper edge of the clamping ring unexpanded, so that it still fits inside the cover. This would, however, require special tools, and the use of a cover for weighing would only be essential for permeability tests made at other than ambient room temperature. For our present purposes the weighing was done at the testing temperature and the cover was accordingly found to be unnecessary.

* An expander for this purpose can readily be made by turning the end of a short piece of 3" iron pipe down to the proper taper and pressing it into the rim. This rim is then pressed over the cloth in the same way as the outer ring of an embroidery hoop.

Fig. 1—Permeability Test Cup.

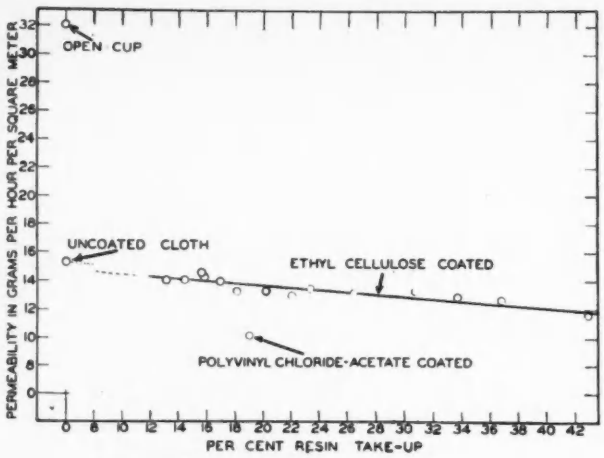

Fig. 2—Water Vapor Permeability.

Experimental Error: We have found that the results are readily reproducible within ± 4% by our method. The smallest weight loss in 16 hours was 1.0 gram. A further reduction of the error may be possible by closer attention to some of the details involved, such as quiesence or constant velocity of the air outside the cup, constancy of temperature and relative humidity, edge leakage, and use of a cover while weighing. The accuracy was, however, considered ample for our present investigation. By using complicated methods of clamping or sealing, refined temperature and humidity controls, and other intricate arrangements, a reproducibility of ± 2% has been attained by other investigators. It is felt, however, that the complexity of these testing procedures is largely responsible for the paucity of data which prevails on the transmission mechanism of water vapor through cloth. Because of this lack of data it has been necessary to resort to conjecture instead of knowledge in designing protective fabrics.

Experimental variations might be thought to be due to: (a) lowering of the water level in the test cup; (b) lack of equilibrium conditions before the first weighing; (c) varying tautness of the cloth; (d) edge leakage at the seal; (e) changes in barometric pressure during the test; and (f) humidity gradients in and outside the coated cloth.

(a) *Effect of Water Level*: Kline[12] has found that with paint films there is no variation of the permeability values with changes in the distance of the water level from the membrane, even up to actual contact with the water. This is at variance with the results shown by Charch and Scroggie[8] on cellophane, and by Abrams and Brabender[1] on paint films, who have found that there is very appreciable variation with the height of the dish above the water level.

In order to determine this point for our case, four cups with membranes having different permeabilities were exposed for four consecutive days. The total loss of water over this period varied from 6.6 grams to 10.3 grams or 13.2% to 20.6% of the initial amount of water used, with the water level dropping proportionately. From the results in Table IV a slight and somewhat irregular downward trend in rate may be noticed, but the reduction is within the experimental error.

TABLE IV
Effect in Drop of Water Level
Permeability expressed in grams/sq. meter/hour

Cloth sample	*1st day*	*2nd day*	*3rd day*	*4th day*
Ethyl cellulose-coated	13.3	12.9	13.0	13.6
Vinyl resin-coated	10.2	10.1	10.1	9.9
"Zelan"-treated	16.1	15.0	14.7	14.7
Untreated	16.1	16.0	15.3	15.7

(b) *Equilibrium Conditions*: Although all cloth swatches were conditioned over night before mounting them on the test cup and weighing, relatively large inconsistencies were found during the first experiments. These are exemplified by the permeability values shown in Table V for successive periods, first of 10 minutes each, then increasing to a final interval of 17 hours. The two samples are from the same piece of vinyl resin coated cloth.

TABLE V
Permeability Values for Successive Periods
Grams/sq. meter/hour

Sample	*Minutes from start*							*Hours from start*			
No.	10	20	30	40	50	60	80	2	4	6	23
1	12.6	13.6	11.3	10.9	11.3	12.4	11.5	10.7	10.2	10.2	10.1
2	11.6	14.6	11.3	11.2	11.8	13.6	10.7	11.2	10.4	10.5	10.2

It is readily seen that the initial variations show no definite drift and that the values level off after two hours. Since the initial variations are inconsistent, they are not likely to be due to ordinary conditioning, but most probably to the manipulation during the weighing, which causes varying air movement over the cloth. With longer intervals this effect is less. It could, presumably, be overcome by using covers while weighing. The exposure over night with a two hour preconditioning period was, however, preferred for present purposes, because during working hours even the long exposure periods did not always give consistent results. It must be assumed that these irregularities were due to stray air currents caused by occupants of the room.

There is a question whether conditioning of the coated cloth before the test is at all necessary when non heat-reactive coating materials are used, such as cellulose derivatives and most vinyl resins, and the coated cloth has been sufficiently dried to evaporate all solvents. When a two-hour equalizing period is allowed, the prior conditioning is presumably unnecessary also as far as the cotton is concerned. Edwards and Wray[9] have shown that the permeability of paint films changes within wide limits during the whole useful life period of the film. Lishmund and Siddle[14] point out that calculation per unit of film thickness is not advisable since such films are not homogenous throughout, because changes due to aging gradually progress inward from the surface and alter the permeability. Kline[12] has arbitrarily adopted an aging period of approximately 30 days before testing. The need for such an aging period is thought to be definitely limited to heat-reactive and air-oxidative plastic materials, such as the alkyd and phenolic resins and drying oils, used in paints. Tests over

a period of approximately two months on new ethyl cellulose-coated fabric and on previously aged vinyl resin-coated fabric have given results which did not vary by more than the experimental error, as exemplified by the results shown in Table VI.

TABLE VI
Effect of Aging
Permeability expressed in grams/sq. meter/hour

Fabric samples	*First Test*	*Second Test 2 months later*
Ethyl cellulose coated	13.3	13.0
Vinyl resin coated	10.2	10.2

(c) *Tautness*: Gregory[11] states that the tension applied in mounting fabrics (uncoated) has no measurable effect on their permeability to water vapor. It does not necessarily follow that this must also be true for coated fabrics. By the clamping method which is recommended here, a very even distribution of the tension is provided and a rather fine adjustment of the total tension used is possible. The data presented in Table VII bear out the fact that even extreme variations of the tautness did not cause variations in permeability greater than the experimental error. At one extreme the clamping ring was pressed on so tightly that there was considerable difficulty in removing it; at the opposite extreme it was so loose that the cloth was slack and barely remained in place. Commercial vinyl resin-coated fabric was used for this test.

TABLE VII
Effect of Tautness on Permeability

Degree of tautness	*Grams/sq. meter/hour*
Very tight	10.1
Tight, normal	10.4
Loose	10.5
Very loose	10.7

(d) *Edge Leakage*: In this case there is no direct way for measuring accurately the possible leakage along the seal of the cloth to the cup. Since the coated side of the cloth is pressed against the edge of the cup, the coating should act as a gasket, but reversal of the cloth on the test cup gave no appreciable variations of the results. If a break in the coating should occur, the results of parallel tests would show random variations. The seal could be improved by applying a suitable wax along the edge. This would introduce the difficulty of redetermination of the free cloth area in each test.

In order to obtain some idea of the leakage possibility, four cups were covered with aluminum foil, 0.0015 in. thick, and only one cup (No. 4) was sealed with unbleached beeswax along the clamped edge. The results are given in Table VIII and it is seen that the possible error is unappreciable, amounting at the most to 1%. The observed small weight loss with the sealed dish may be due to porosity of the aluminum foil and should, in that case, be applied as a deduction on the first three results.

(e) *Barometric Pressure*: The tentative A. S. T. M. method D697-42T[5] for water-vapor permeability of plastic sheets prescribes the use of a tare weight of approximately equal volume and 10 grams less weight than the

TABLE VIII
Weight Loss of Test Cups With Cloth Replaced by Aluminum Foil

Test Cup No.	*Total loss Grams/hour*	*Possible error Grams/sq. meter/hour*
1	0.00061	0.101
2	0.00049	0.081
3	0.00051	0.084
4 (wax sealed)	0.00010	0.017

loaded test cup, in order to minimize the weighing error caused by changes in buoyancy of the air due to major variations in the barometric pressure during the test. While this is an accurate compensation only when this counterpoise encloses as much air as the sample cup and is provided with a membrane of equal tension and porosity as the coated cloth on the test cup, it has been found to be an indispensable aid for highly accurate permeability determinations. But since the present work dealt with more permeable membranes, giving fairly high weight losses, this precaution was unnecessary. The total volume of the test cup is 207 ml. Assuming this volume to be constant, a change in barometric pressure of 2 inches over night would cause a weight change of 13.5 milligrams. The largest error which this could produce is ± 1.4% because the smallest weight loss over night was 1.0 gram.

(f) *Humidity Gradients*: If the air within the test cup is not uniformly at the saturation point as regards humidity or, in other words, if diffusion through the cloth takes water vapor away faster than diffusion through the air space can supply it, the amount of water vapor passing through the cloth is less than would correspond to its permeability under the assumed differential of saturation in and outside the cup (35%). The same would be true if a layer of water vapor would be allowed to build up outside the cloth. Such conditions would have the effect of obliterating differences of permeability and distinctions between different coatings. A more detailed discussion of this effect is given by Abrams and Brabender[1] and by Carson[7]. Since we have obtained relatively large differences between the permeabilities of different coating materials, this effect is not believed to be serious. This is also indicated by the fact that no appreciable drop of the permeability values has been found with increasing distance of the water level from the cloth (see Table IV). The purpose of the present work was, moreover, to make practical permeability comparisons rather than to determine absolute values.

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Sulfonated Peanut Oil—

(Concluded from Page 149)

a good hand, a very "slick" finish and bright color. The peanut-castor oil used cost 23.5 per cent more per unit than the oil previously used but since 26.6 per cent less of the mixture was used the price compared favorably with other oil used. (Price as of 1941.)

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SUMMARY

Peanut oil is easily sulfonated. The sulfonation proceeds smoothly and washing can be facilitated by breaking the emulsion with a 15 per cent solution of Na_2SO_4. Oils not too old and treated with an inhibitor show no odor when applied to textiles. The oil is a good emulsifier.

ACKNOWLEDGMENT

Acknowledgment is made to C. M. Stodghill & Co., Atlanta, Ga., for co-operation in this work.

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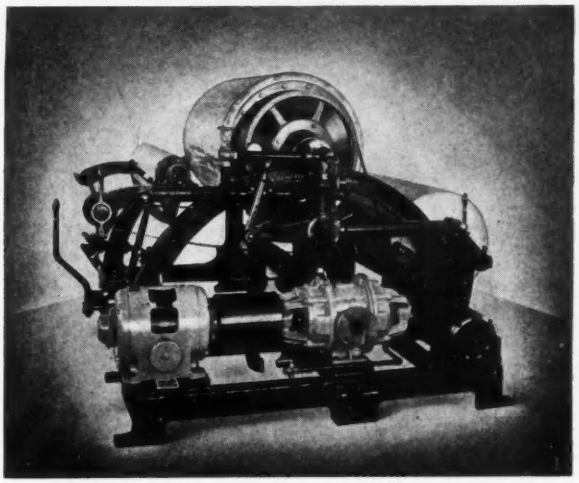

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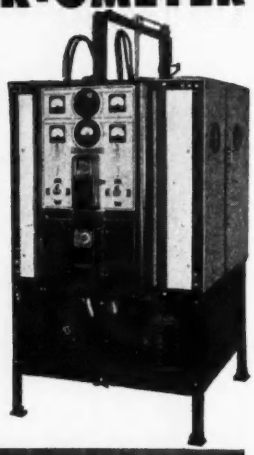

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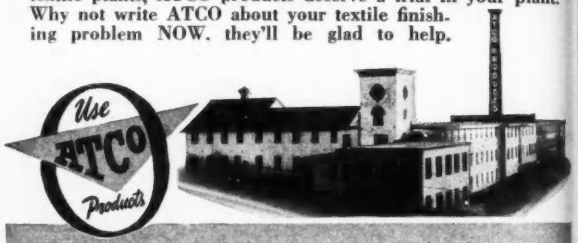

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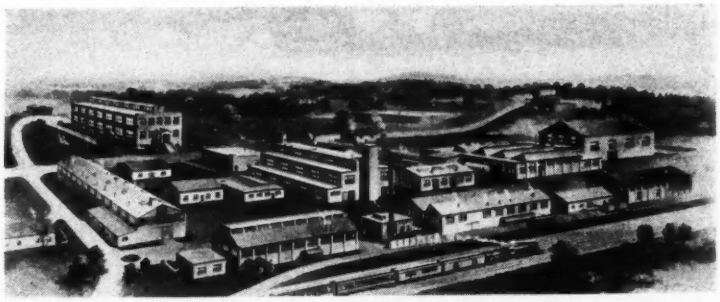

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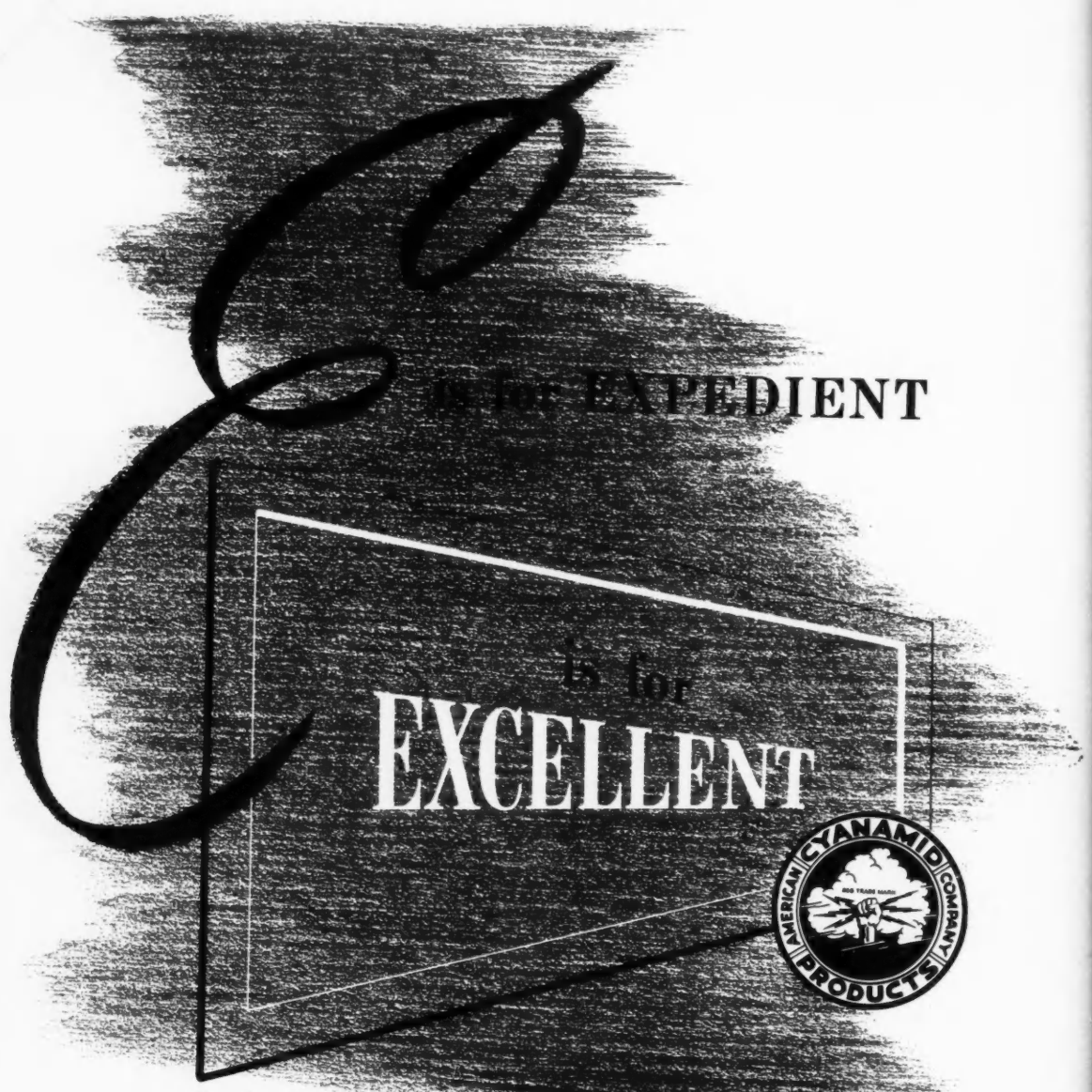

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